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Mather, S. — Adirondack Lakes (1886)

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March 23, 1901.

MAR 23 1901

Prof. J. D. Whitney
With the Compliments of
Respectfully Yours,

STATE OF NEW YORK.

Adirondack Survey.

VERPLANCK COLVIN,
SUPERINTENDENT.

FROM THE APPENDIX TO THE TWELFTH REPORT.

(ZOÖLOGY.)

MEMORANDA RELATING TO

ADIRONDACK FISHES,

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CAMBRIDGE, MASS.

WITH

DESCRIPTIONS OF NEW SPECIES,

FROM RESEARCHES MADE IN 1882.

BY

FRED. MATHER,

ASSISTANT TO THE U. S. FISH COMMISSION, SUPERINTENDENT LONG ISLAND HATCHERY OF THE NEW YORK FISH COMMISSION, ETC.

Printed in advance of the Report.

ALBANY:
WEED, PARSONS AND COMPANY,
LEGISLATIVE PRINTERS.
1886.

LIBRARY
MUS. COMP. ZOÖLOGY
CAMBRIDGE, MASS.

ADIRONDACK FISHES.

ERRATA.

Page 7—10th line from bottom, for "Sents lake" read Scuts lake; and for "Coald lake" read Cold lake.

" 7—11th line from bottom, strike out "Piseco lake."

" 21—16th " " top, " " "Midriffs."

" 23—10th " " bottom, for "Canadack" read Canada creek.

" 23—bottom line, for "300" read 200.

" 25—14th and 18th lines from top, for "Count's" read Coombs.

" 25—16th line from bottom, for "4¼" read 2¼.

" 34—20th " " top, for "Commersoni, name," etc., read Commerson, name, etc.

" 34— 4th line from bottom, for "three" read these.

" 37— 8th " " " " "construction" read constriction.

" 37— 5th and 7th lines from bottom, for "ventrals" read pectorals.

" 38— 3d line from top, strike out comma after "depth" and insert it after "tapering."

" 47—21st line from top, for "Micks" read Nicks.

" 50— 5th " " bottom, for "the Midkifs" read Metcalf.

" 54— 6th " " top, strike out "Midkifs."

" 54—10th " " " for "1879" read 1877.

" 54—17th " " " " "Midkifs" read Metcalf.

" 54—18th " " " " "Micks" read Nicks.

" 55—11th " " " strike out "Piseco, G."

" 55—16th " " " " "Bisby."

STATE OF NEW YORK.

Adirondack Survey.

VERPLANCK COLVIN,
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Appendix.

ADIRONDACK FISHES.

BY FRED MATHER.

To the Hon. VERPLANCK COLVIN,

Superintendent Adirondack Survey:

SIR:—I have the honor to submit the following report on the ichthyic fauna of the Adirondacks, as collected by me in the year 1882, at your request. I can only regret that it is not more complete, as it is possible that the waters may contain other species not observed by me during the limited time, in which the collection was made.

The investigations in this direction have developed some facts which subsequent correspondence has shown are not generally known, and therefore may be deemed of some value in extending our knowledge in this department of zoölogy. At the same time I wish to say, that I do not consider that the field has been exhaustively worked. The collection was made in June and July in a trip from the upper Hudson at 13th Pond stream near North river, on the Hudson, across to Blue Mountain lake, Eagle, Utawana, Raquette, and the Fulton chain of lakes, with detours covering Forked, Long, Big Moose, Little Moose and Panther lakes, and the many inlets and ponds that are tributary to them. In October and November an examination was made of the waters in the northern portion of the Adirondack region over Meacham lake and the ponds in Franklin county. These trips yielded a good collection of fishes, which were preserved in alcohol sent by Prof. Baird, Commissioner of Fish and Fisheries of the United States, to whom the specimens have been sent, and who will forward them to the International Fisheries Exhibition to be held in London in 1883, as a collection of the fishes of the great angling region of the State of New York. A chart will also accompany them showing the distribution of species, illustrated by lines of a different color, for each of the more important fishes.

In the labor of collecting and determining species, I have been greatly assisted by several gentlemen to whom due credit will be given in the course of the report, and I have also received material assistance

in determining the approximate range of each species by correspondence, for which many thanks are due to those who have kindly responded to my inquiries, and which will also be acknowledged in the proper place. Mr. E. L. Sheppard, the noted guide of Brown's tract, kindly sent with me by you, and Mr. A. R. Fuller, of Meacham lake, were of the greatest service, not only from their intimate knowledge of the country, but also from their life-long observance of the habits of all living creatures that inhabit this region.

The nomenclature adopted in the description of the fishes, is that in use by the best ichthyologists of the day and approved by the Smithsonian Institution. To render it more intelligible, I have given as synonyms, the nomenclature of former writers on fishes, and, as far as I could obtain them, the local or popular names by which they are known in different parts of the wilderness. The popular names of fishes are so badly mixed that it is often impossible to tell what fish is meant by a local name unless one happens to be familiar with it. A species of *Coregonus* ("whitefish" of the great lakes), is called "shad' in Lake Champlain, and the guides led me far astray in search of a fish which they called "dart" or "darter," a name applied to one of the small bottom fishes of the family *Etheostomatidæ* in most other parts of the country, while I have good reason to believe that the fish which they referred to belongs to an entirely different family, *Cottidæ*, whose habits are much the same, but whose structure differs very much. As it is only the trained naturalist who observes the structure of fishes and passes their colors to a place far in the rear in the determination of species, I will make no apology for using the systematic names in describing the fishes, because many of them have no other names, and it is only by means of these that the identity of species can be established. I make this explanation on account of the number of persons who "do not see the use" of a nomenclature which is common to scientists in all parts of the world, and who scoff at it because they do not happen to understand it. A more extended field of observation will show them that the name "sucker" is applied to fifty or more species of fresh water fishes which belong to ten or twelve genera, but only one family however, and to several species inhabiting salt water which are not at all related to each other; also, that the name "frost-fish" is applied to a member of the salmon family in the Adirondacks and to one of the small members of the codfish family on the sea coast. Examples of this kind could be cited almost indefinitely. With the remark that in no waters of the Adirondacks, except on its borders, did I either find or hear of one of the most common of New York fishes, the yellow perch, *Perca fluviatilis*, I will proceed to the description of species.

FAMILY CENTRARCHIDÆ.

The sun-fishes, bass, etc. (*Kentron* a spine, *archos* the anal fin.)

These are percoid [perch-like] fishes which have both spinous and soft rays in the single dorsal-fin, which is either continuous or perhaps deeply divided, but which do not have two distinct dorsals as in the families *Percidæ* (the perch) and *Labracidæ* (the basses of salt and brackish waters). The family is distinguished from others of the sub-order *Acanthopteri*, or spiny-rayed fishes, which have their teeth in villiform bands, by its large anal fin with from three to nine spines and by their nest-building habits. The patches of teeth, which are like bristles [villiform], are sufficient to separate the family from any other found in the Adirondacks. In this family we find :

THE SMALL MOUTH BLACK-BASS.

Micropterus dolomieu Lacepede, Henshall. (*Micros*, small ; *pteron*, a fin ; *Dolomieu*, name of a naturalist.)

SYNONYMS.

Black Bass. Western New York.
Chub. Virginia.
Grystes salmoides. De Kay, Fishes of New York. 1842.
Grystes sp. Cuv. et Val., Hist. Nat. des Poiss. 1829.
Grystes sp. Swainson, Nat. Hist. and Class Fishes. 1839.
Centrarchus obscurus. De Kay, Fishes, New York. 1842.
Centrarchus fasciatus. De Kay, Fishes, New York. 1842.
Bodianus sp. Rafinesque Am. Mag. and Crit. Review. 1817.
Calliurus sp. Jour. de Phys. 1820.
Huro nigricans. Frank Forester. 1820.
Micropterus salmoides. Gill.
Trout in all States south of Georgia.
Micropterus achigan. Goode, Game Fishes of the U. S. 1878.
Micropterus salmoides. Jordan, Manual of Vertebrates. 1878.
"True Black Bass" of a few sporting writers.

This fish is not a native of the Adirondacks, nor in fact of any waters east of the tributaries of the western portion of Lake Ontario and a few lakes of western New York. The range extended from these through the great lakes to Minnesota and southward. Several species, and even genera, were recorded by the older ichthyologists but Dr. Gill reduced the list to one genus and two species. These he separated into the large and the small mouthed. The former, by some strange fancy, was locally called "Oswego" bass, near Lake

Ontario, notwithstanding it was the most widely distributed of the two, its range extending to Florida where it grows to twelve pounds weight. The small mouth, *M. dolomieu,* was introduced into Brown's tract inlet, flowing into Raquette lake, some years ago by the New York Fish Commission, and now they are plentiful in the lake and are working down into Forked lake and toward Long lake. I do not think it necessary to give a description of this fish, so well known to the angler, further than to say that the species is determined by closing the mouth and noting whether the maxillary bone extends to or beyond the centre of the orbit. If it stops about opposite a vertical line from the centre of the eye and the fish has a few minute scales extending on the membranes of the dorsal and anal fins and its scales are small, about 70 to 80 in the lateral line, then it is safe to call it a "small mouth black bass," the only species known to me to exist in the Adirondacks. If, however, the maxillary bone extends to the posterior portion of the eye and there are no scales on the vertical fins and its scales are large, only 65 to 70 in the lateral line, then the fish may be called the "big mouth black bass," a species not known to me to exist in this region, although contrary to received opinion it inhabits cold as well as warm waters, being found as far north as its congenor.

The black bass is very destructive to trout and other soft-finned fish. It makes a nest in the gravel in May or June and deposits its glutinous eggs on the stones where they adhere until hatched. The old fish watches the nest, and if circulation of water is needed, fans the eggs with her tail and fights off all intruders. This habit is common to the family and is shared by the next genus as well as all others in it. The black bass is very gamy when of two pounds weight or under; but the larger ones do not seem to fight as hard when hooked as do the smaller ones. There is a prevalent theory that this species is "gamier" than its cousin the big mouth or "Oswego" bass, an opinion that I am not prepared to endorse, as I have found but little difference between them when both were under two pounds weight. Dr. Henshall, in his "Book of the Black Bass," does not refer to any difference in this respect, and while I do not care to say that there is none, I incline to think that the game qualities of the big-mouth have been underrated. As a game fish black bass deserve high rank. As a table fish they are below mediocrity, and they should never be put into waters where trout will thrive. They are found in Racquette, Forked, White, Fourth Bisby and Sucker lakes, Black and Moose rivers and in Partlo pond, St. Lawrence county. They make nests in gravel near the shore and guard them. In all of these localities it exists as an introduced species.

SUNFISH.

Eupomotis aureus (Walb.) Gill & Jordan. (*Eu*, well or true; *poma*, the opercle; *ous*, ear; *aureus*, golden.)

SYNONYMS.

Pomotis vulgaris. De Kay.
P. auritus and *P. maculatus*, of authors.
Bream, in Southern States.
Pumpkin seed, pond fish, etc.

The largest specimen in the collection was taken in Fourth lake, Fulton chain, and was five and a half inches in length; depth, two in length; head, three in length. Fin rays: dorsal single with ten spinous and ten soft rays; Anal. III, 9; Ventrals, I, 5; Pectorals, thirteen, fifth ray longest. Shape, nearly circular, back elevated; mouth small; teeth, none on maxillaries; premaxillaries forming front edge of mouth with fine villiform teeth; patches of teeth on both jaws and on crest of vomer; opercles scaly, flap small; lateral line following curve of back and containing forty-four scales; six rows of scales above the line and fourteen below; caudal fin scaly and lightly forked; color, greenish olive above, greenish on sides and yellow on belly; black spot on opercle bordered with scarlet; cheeks mottled with orange and blue.

This little fish is quite handsome but it is a voracious feeder and no doubt destroys great quantities of the eggs and fry of valuable species. The spiny fins protect it, and its pugnacity is so great, especially when nesting, that it does not hesitate to attack a large fish or even a stick thrust near it. It makes nests in the gravel, usually near shore, and watches its eggs and young after the manner of the bass. I incline to think there is but one species of this fish in the Adirondacks, although the southern portion of the State contains others. They are found in most of the Adirondack waters, the exceptions, according to my correspondents, being Piseco lake, G lake, Coald lake, Sent's lake, T lake, Willis pond, Murphy, Warner and Bug lakes.

FAMILY COTTIDÆ.

Kottus, head.

This family has members in both salt and fresh waters and includes the sculpins of the former and the miller's thumbs of the latter. I was not fortunate in my search for the species said to be found here, although I heard of a fish answering my description, from several persons. I was expecting to find some of the little sand-darters [Family Etheostomatidæ, genera several, but one of the species of

Boleichthys in particular], and in describing the movement of the darters on the bottom to Mr. Sheppard, my guide, he said he had seen such a fish near the shores of Big Moose lake and had collected it for Dr. Merriam. He knew the darting motion perfectly and explained how it was made by the pectoral fins entirely, while the caudal acted as a rudder, and, as he called it a "dart" I was deceived into thinking that it must be *Boleosoma*. We searched the shores of Big Moose and all its inlets without reward, and after going back to the Forge House other guides corroborated Sheppard's statements, which, of course, had added weight. Continuing our course we visited Little Moose and Panther lakes without finding this apparently rare species. It was after my return home that it occurred to me to write to Dr. Merriam and ask him if he had seen *Boleosoma*, or any related genus, in the Adirondacks. Knowing his ability as a naturalist and his long residence on the edge of the woods, I felt confident if the fish was there, and Sheppard said he had collected for him, that I could be assured of the fact. I wrote him and received the following:

LOCUST GROVE, LEWIS CO., N. Y., *August* 16, 1882.

MR. FRED MATHER:

My Dear Sir: — Your favor of the 12th received. I have never seen any of the darter, *Boleosoma*, in Big Moose waters or vicinity. Should like, if practicable, to join you in the woods next October. At any rate you had better come and see me and start in from this side. An annotated catalogue of the fishes of the Adirondack region will constitute chapter 6 of my "Vertebrates of the Adirondacks," chapters 1 and 2 of which are now in press.

Sincerely yours,

C. HART MERRIAM, M. D.

I then wrote him again as follows:

OFFICE OF FOREST AND STREAM, NEW YORK, *August* 20, 1882.

DR. C. HART MERRIAM:

Dear Sir: — I have your letter of the 16th inst. I am confident that there is a fish about the waters of Big Moose which I have not obtained, and which, if not a darter, has its habits. I may have been wrong in assuming that it is the *Boleosoma*, for it is possible that it might be one of the *Cottoids*, whose habits are similar in respect to motion. Sheppard says he collected it for you and he calls it the "dart."

Cordially yours,

FRED MATHER.

To this the following reply came:

LOCUST GROVE, LEWIS CO., N. Y., *August* 22, 1882.

My Dear Sir: — Your favor this day received. It enables me to solve the mystery. The fish in question is *Uranidea gracilis*, which

is common in Big Moose and other Adirondack waters. Probably *Boleosoma* may inhabit the Big Marsh, but I have not yet taken it.

Sincerely yours,

C. HART MERRIAM, M. D.

Therefore, on the authority of Dr. Merriam, I will insert in the family *Cottidæ*, the

MILLER'S THUMB.

Uranidea gracilis (Heckel) Putnam. (*Ouranos*, the sky; *eido*, to see [star gazer]; *gracilis*, slender.)

SYNONYMS.

Bull-head. In England.
Devil-catcher. Parts of New York.
Eel-chaser. Southern New York (Jack Sheppard).
Uranidea quiescens. De Kay.
Dart. Adirondack guides.
Little star-gazer. De Kay, pl. v, fig. 14.

Jordan says: "Manual of the Vertebrates," p. 252, "Tips of pectorals reaching fourth ray of second dorsal and first of anal; head 4 in total length; eye 4 in head; grayish, mottled. D. VIII—16; A. 11 or 12, New England and New York; the common eastern species found 'quiescent' under stones after the manner of the darters."

This little fish seldom exceeds three inches in length, although Mr. A. R. Fuller, of Meacham lake, tells me that in streams about Malone they are found of twice that length. They are naked fishes with an eel-like skin and a large head, which has a most diabolical expression. De Kay's figure is very bad. I once took one on a small hook when a boy and was fishing for trout with a worm, but ordinarily they do not bite at the lure of the angler.

FAMILY GASTEROSTEIDÆ.

Gaster, the belly; *osteon*, bone.

THE STICKLEBACKS.

I looked earnestly for a member of this family but failed to find one. As they inhabit the cold spring waters of other parts of the State it was reasonable to expect them here. They may exist here, however, as it is not to be supposed that in my short search of these waters every thing that exists there was obtained. Therefore, as they are likely to be found here I mention the family, which comprises four genera and some five or six species.

FAMILY ESOCIDÆ.

THE PIKES.

I found but one species of this family, and as it has four species which are found in New York I will enumerate them all for the benefit of anglers. I believe that it is the only one found in the Adirondacks. This family is distinguished by its elongated sub-quadrate or nearly cylindrical body; a single dorsal fin placed far back and about opposite the anal fin; small scales; large mouth with prominent strong hooked teeth. In America there are at least six species, one of which is the common pike of Europe, and the only one of the family that is found outside of America.

THE PIKE.

Esox lucius, Linn. (*Esox*, lat. a pike; *lucius*, old name of pike.)

SYNONYMS.

Pickerel. New York.
Pike. Canada and Europe.
Great Northern Pickerel. Frank Forester, "Fish and Fishing."
Muskellunge (erroneously). De Kay.
Esox estor. De Kay.
Jack. Virginia and Tennessee.
American Pickerel, or Pike. Genio C. Scott, "Fishing in American Waters."
Great Lake Pickerel. Norris, "American Angler's Book."
The Pike. Goode, "Game Fishes of the United States."
Esox lucioides, E. boreus, of other authors.

This fish is one of two species which are often confounded, especially in parts where the other does not exist. There it is sometimes termed muscallonge, mascallunge, maskinanga, or, what I believe to be the correct form of this variously spelled name, maskinonje, *Esox nobilior*, Thompson. It differs from the latter in having its cheek entirely scaly, while in the maskinonje the lower portion of the cheek is bare. Sometimes the sides of both fishes are almost a plain solid color, but generally the pike is marked with white oval spots on a dark grey ground, while the maskinonje has black spots, if any. Its scales are also larger than those of the latter fish, having, according to Jordan, 122 in the lateral line, while the maskinonje has 155. The other species are: The maskinonje, or muscallunge, *E. nobilior*, Thompson, a species peculiar to the great lake system, and reaching a weight of forty pounds and upward. The pickerel, *E. reticulatus*, a fish found in southern and western New York and adjoining States, which often

bears the same common name as the great pike of which we write. *Reticulatus* is distinguished by having both its cheek and opercle scaled, and has usually a system of black network on its sides of green or olive, from whence its specific name of *reticulatus* is derived. It seldom exceeds four pounds in weight. The other species are small, seldom of half a pound, and need not be described here. As the name "pickerel" originally meant a small pike, it is evidently a misnomer when applied to a fish which often reaches thirty or more pounds, and, to an ichthyologist, it is a matter of surprise that our observant anglers do not distinguish between fishes so plainly marked as *E. lucius* and *E. reticulatus*, and that they call them both "pickerel."

The pike is found in Long lake and Forked lake, and I am informed by correspondents that it occurs in Spectacle, (see next species) Dexter, Willis, Murphy, Gates and Tupper lakes, and in the Raquette and Sacandaga rivers. The fish is not indigenous to Adirondack waters, but was introduced into Long lake by Lysander Hall and Robert Shaw about twenty years ago. I have not been able to fix the year, but from conversing with different persons think that it was somewhere between 1860 and 1865. I quote the following from my "Adirondack Survey Notes" to *Forest and Stream:*

"There is a fish in Long lake which some call a muscalonge and others a pickerel," said the guide, "and no one seems to know exactly what it is, or, if they do, the others who differ from them don't accept their decision. You should go there and see the fish and settle it."

"Certainly, we will go," said I, "what will we want in the way of blankets and baggage?"

"Nothing; go as light as possible, take your rods and creel and that is all we will want. We will leave Fourth lake in the morning about ten, dine at Bennett's on the Raquette, go down the lake and river, carry into Forked lake and again down the river to Buttermilk falls, where we have a short carry and then a longer one of half a mile into Long lake, where we will stop for the night at Kellogg's and fish in the morning. After getting what you want we will come back by way of South pond, Mud pond, Minnow pond and Blue Mountain lake, fishing them all, and no doubt some new specimens will be found in some of these waters which we have not picked up yet."

We followed this programme and on arriving at Kellogg's on Long lake, we found the question of maskinonje versus pickerel being argued in the hotel office. One man said that he had been all through New York markets and had asked the differences between the fish, and the market men had always shown him fish like those in the lake for maskinonje, or muscalonge as it is here called. Fortunately the land-

lord had one in the kitchen and Sheppard suggested that it be shown to me. On producing it there was no difficulty in determining it to be the great lake pike, or pickerel, *Esox lucius.* It is singular how much mixed the mass of anglers are about this family of fishes. The colors alone are sufficient, generally, to identify them without going into the structural differences, as scales on cheek, etc., yet many who can distinguish the two named do not distinguish the great pike from the smaller pickerel, *E. reticulatus,* the one which only grows to five or six pounds and has black network on its sides, but call them both "pickerel." We only stopped next day long enough to take four specimens, two of which were too large for the alcohol tank, and therefore had to be given away. The smaller ones, about two pounds each, were preserved.

PICKEREL.

Esox reticulatus, Linn. Le Sueur. (*Reticule,* a net, from the markings on the sides.)

I have reason to believe that this species is found in Adirondack waters although I did not see it. My reasons for believing this are: I am informed that a small "pickerel" is found in other waters than Long and Forked lakes and that "they look different from the big kind." These fish were planted in the "south woods," and were brought in from Stratford, Fulton county, about 1842, by Ebenezer H. Hart and Ebenezer H. Bleekman, both of Stratford and both now dead. The fish were planted in Ayer's lake, and the two Spectacle lakes, Fulton Co. Afterward, Dexter lake and others were stocked. This smaller fish is sometimes distinguished as the "shark pickerel," and is rightfully considered as a great trout destroyer.

In this connection I wish to say that a region which produces brook trout in the numbers that the Adirondack has done, should only have new fish introduced after mature deliberation and consultation with fish culturists and others who have studied the habits of fishes. It would be no great harm to either fish culture or to the angler if every specimen of this family was destroyed. They devour more good fish in a year than a hundred fold their value, either for food or angling, and are comparatively worthless for the table and yield but little sport to the angler who prefers the active enjoyment of fly-fishing to the lazy pleasure of trolling a spoon or a minnow gang.

FAMILY SALMONIDÆ.

THE TROUT AND WHITEFISH.

This family includes those fishes known as salmon, trout, smelt, grayling, whitefish, lake-herring, etc. The distinguishing marks of

its members are: body with scales of small size, almost invisible in some genera, head without scales, a second dorsal fin which is without rays, and is placed far back and is composed of fat entirely, a fin found in no other American family of fishes except the catfishes; air-bladder of large size and single.

SALMON.

Salmo salar. Linn.

Salmon is only found at present near the Adirondacks, in Salmon river, in Oswego county, emptying into Lake Ontario near Pulaski. It was formerly plenty, but has become scarce of late years. In May, 1882, I deposited 25,000 young fish in it by order of Professor Baird, commissioner of fisheries of the United States, which I had hatched on Long Island.

LAND LOCKED SALMON.

Salmo salar, variety *sebago.* Girard. (*Salmo* and *salar* derived from *salio,* to leap; *Sebago,* a Maine lake.)

SYNONYMS.

Schoodic salmon. Atkins, U. S. Fish Commission.
Sebago lake trout. Jordan, Manual of the Vertebrates.
Salmo sebago. Girard.
Salmo gloveri. Girard.
Salmo omiscomaycus. Walbaum.

This is undoubtedly a descendant of the true sea salmon whose ancestors were cut off from their descent to the sea by some convulsion of nature in the State of Maine, to which they are native and where they originated, and being compelled to live and breed in fresh waters their progeny have lost the anadromous habit and "find their normal sea in the lakes." The angler can distinguish them from the *S. salar* by the shape and color, but there is no structural difference between the fishes that an ichthyologist can seize upon to render his description intelligible to one who has not both before him, and symmetry and color count for little in fishes, being often dependent upon water, food and bottom.

This fish, from its habit of living and breeding in lakes of low temperature, is a most valuable one for the Adirondack region. (See "The Salmon of Maine," by Dr. A. C. Hamlin, Rep. U. S. Fish Com'r., 1872–73.) Gen. R. U. Sherman, of the N. Y. Fish Commission, writes under date of Sept. 4, 1882, as follows: "There are no land-locked salmon in the Bisby's; none have been placed there; the whole plant

of 1881 was made in Woodhull. I heard last summer of one being caught of two pounds. I have seen them of the weight of one and a half pounds. There are none taken, I think, after June, but they will soon be on their fall run when I can secure specimens for you."

The following, by Mr. Charles G. Atkins, assistant to the U. S. Fish Commission, who has probably had more experience in breeding this fish than any other man, will be of interest. It originally appeared in *Forest and Stream* of Feb. 15, 1883:

MEMORANDA ON LAND-LOCKED SALMON.

BY CHARLES G. ATKINS.

"A.—*Systematic Position.*—There have been thought to be several distinct species, or at least several naturalists finding land-locked salmon in this or that district, have thought them new species and have called them *Salmo sebago, S. gloveri,* etc. Within a few years Bean, and others in Washington, have carefully compared them with *S. salar,* and find no specific difference.

Difference in size is commonly very great, land-locked salmon in general being but one-fourth or one-fifth the size of the river or sea salmon. Same differences in color. Land-locked salmon never in breeding season assume so bright colors as male river or sea salmon. Aside from these unimportant differences may be mentioned as more important the difference in habits, land-locked salmon never going to sea, as a rule, though likely that it sometimes has occurred to stray individuals to descend the St. Croix or Presumpscot to the sea. They find their normal sea in the lakes. Also may be noted that though in maturity smaller, in embryonic stages the land-locked salmon are larger, the eggs perhaps being ten per cent greater in diameter. Strange!

Another interesting point of comparison is the retention of the embryonic markings to a much greater age by land-locked salmon. I have seen a Sebago salmon thirteen inches long with the dark bars on the sides still very distinct, and in removing the skin of adult land locked salmon, I have found the marks still distinct on the under side of the skin, and on the membrane that still covered the flesh, as though the restriction of the land-locked salmon to fresh water had stopped his development, keeping him still in a somewhat embryonic stage.

B.—*Range.—Four districts in Maine, viz.:*

1. Basin of Presumpscot river (Lake Sebago, etc.)

2. Basin of Sebec river, a branch of Penobscot — not known to be found in other parts of Penobscot basin. Singular that they have not spread all through the Penobscot. It has many lakes seemingly well fitted.

3. Basin of Union river, Hancock county.
4. Basin of St. Croix river.

The fish of the Presumpscot and St. Croix had earlier a wider range than the others, and in both rivers were occasionally taken almost down to tide-water. Within twelve years I have seen two that were taken at Cumberland mills on Presumpscot.

C.—*Size of Adults.* — This varies much. The Sebago fish often reach eight and ten pounds, and sometimes fifteen. St. Croix (or Schoodic, as we commonly call them) rarely exceed six pounds and average two and a half. They are larger in some parts of Schoodic lakes than others, but these differences are not constant. For instance, in 1875, those caught at Dobsis were nearly twice as large as those of Grand Lake stream, but the latter have increased in size year after year, until now they are about the same as the Dobsis fish. The Union river fish are large, about like the Sebago. The Sebec fish are about like the Schoodic in size.

There are local differences recognizable to one acquainted with the different varieties, but hardly to be described. One interesting point of difference between Schoodic and Sebec fish is this: Sebec fish mature at a smaller size than the Schoodic; and, while still small, frequent same grounds with large ones. Sebec fish apparently mature having lost the red spots and dark bars, may be taken same day, with hook, all the way from eight inches up to two feet in length, but of Schoodic salmon as taken at Grand Lake stream, I have never seen a mature fish less than twelve inches long, very few less than fifteen, and never one that had lost bars and red spots less than eleven, and these small fish, as well as the smaller forms with bars and spots (eight or nine inches long), are rarely found on the same ground with the larger fish.

D.—Grand Lake stream is the head quarters of the variety of Schoodic lakes; that is, to no other stream do so many resort to spawn; and in no other lake do so many find their home as in Grand lake. After the prevailing backwoods system of nomenclature, the stream that flows out of Grand lake is called Grand Lake stream. Here, as in many other instances that I know of, the salmon move down from the lake into its outlet at the spawning season, instead of up into the tributaries. It follows that the young fish instead of dropping down with the current as young sea salmon do, are in the habit of ascending their native streams till they reach deep water above.

Grand lake is one of the finest sheets of water in Maine — clean, wooded shores, and very clear water. Grand Lake stream is a bright, dancing stream, three miles long, quick water almost every rod, and abundant spawning grounds.

E.—*The Breeding Operations.*—For eight years we have been conducting almost the entire business of spawning for the fish. Our traps span the stream at the outlet of the lake. No fish now get past us except by accident — very few actually. With fine-meshed nets we build a series of inclosures. Those which the fish first enter are on the principle of a weir or pound, and few fish ever get out against our will. They come in mostly by night. Every morning we count our catch and assort them, taking spawn from all that are ready. The earliest fish begin to spawn in the stream before the end of October; we begin to take eggs a few days later, the fourth to eighth of November. Many of the females have to be kept some days before they are ripe. (Not so with Penobscot fish — sea salmon — which are generally all ripe together, and some days earlier than Schoodic.) Yield, 1,600 eggs per female. Commonly catch four females to three males. Males come in earlier in the season. First run nearly all males; last nearly all females. Full fish continue to come in until November 20; sometimes not all manipulated till December. Often there is severe cold weather during the spawning season. We operate under cover of a roof. Sometimes ice shuts us off from communication with the lake; but if not, we take the fish we have manipulated in cars and tow them one or two miles up the lake, where they are set free. One-fourth of the spawn taken is hatched here and the fry let loose in Grand lake, to avoid exhausting the supply. There has been no falling off so far. Young are planted along the shore scatteringly where there are loose, rough rocks for them to hide under.

We have three spawn houses, or rather one developing house (exclusively so) and two hatching-houses. The developing house is fed with lake water. Its location compels us to vacate it in March, but the long stay of the eggs in the cold lake water keeps development back so that none are hatched and grown enough for planting till June, when their natural food is become abundant.

Our best hatching-house stands on the lake shore and is a very substantial structure, partly under ground with massive stone walls; capacity for developing four million eggs or hatching one million. Troughs arranged on six floors and water runs through the series, so that it can be used at least three times, with ample facilities for æration. We pass water from one trough to another by letting it fall in a broad, thin sheet over the side of the trough. It is very effective, and young hatched in this house are exceedingly vigorous. The above hatching house covers 1,500 square feet of ground. Have also a neat little cottage for the superintendent, and lodge for foreman, ice-house, wood-house, all in convenient proximity.

Our method of manipulating fish is, perhaps, common. Use "dry

methods," wholly. Ten quart tin milk-pans receive spawn and milt. Fish are used just as the "dipper" hands them up, male or female first, as may chance. After eggs of four or five fish are taken and well milted, another hand takes them, agitates them diligently for a few minutes, and then washes them off at once, after which they stand in pans on shelves till convenient to carry to hatching-house. Careful observation has shown that impregnation is instantaneous upon contact of milt, and all agitation and waiting is merely to secure contact. Milt in pure water loses vitality in a few seconds, retaining scarce any power after one minute. Eggs likewise soon lose capacity of impregnation, if put into water. But a little water does no appreciable harm within a few minutes. Either eggs or milt can be exposed to air for hours without losing power. The mucus that comes from the fish with eggs does not act on milt or eggs like pure water; milt in it retains its power for hours. If males are scarce we strain out the milted liquid from a spawn pan and use it again. In a can standing in water I have kept it forty-eight hours and then used it effectively (this mixed mucus and milt.)

Three-quarters of our eggs are shipped away. Owners are Maine, Massachusetts, Connecticut and the United States. We pack in sphagnous moss, wet to imbed eggs, dry to surround them. Surrounded by three-inch dry moss they go on a sled on a morning with a temperature ten to fifteen degrees below zero, twenty-eight miles (taking whole forenoon), without the frost penetrating. Eggs are ready to pack as soon as the eyes become black. We send all off from January to March. Those we keep are hatched in May and are turned out in June."

In making inquiries concerning the distribution of this fish in the Adirondacks, I have found that the answers differ from what I think to be the facts. This I ascribe to a difference in local names. I ask in a card, which is given farther on, "What waters have been stocked with land-locked salmon?" and find that the answers from different correspondents say: "Woodhull, Mud, Sand, Jordan, Pleasant, Little Moose, Bisby, Butler and the Fulton chain." As the lake trout is miscalled "salmon" in many parts of this region, I do not doubt but some persons who know that it is not the salmon, conclude that it must be the land-locked salmon. This error comes from the fact that in some places the lake trout is called the "salmon trout," and to distinguish the fish from the brook trout they call the latter simply "trout," and the former "salmon." For the benefit of those who use this name for the lake trout, I will say that they will not find a true salmon in the Adirondacks unless in waters close to it and emptying into Lake Ontario (see description of the salmon). The land-locked salmon has

only been planted in the wilderness since 1881. The following letter from a member of the N. Y. Fish Commission, referring to the article in *Forest and Stream*, from Mr. Charles G. Atkins, will be found of interest.

NEW HARTFORD, N. Y., *Feb.*

MR. FRED MATHER:

Dear Sir:—Probably Mr. Atkins has as much practical observation of the habits of the land-locked salmon as any man in the country. His statement of their habit to go down to the streams to spawn, instead of up, as other salmon do, is confirmed by what occurred at Woodhull last fall. From appearances the whole stock went out of Woodhull dam through the open gates and gathered in the stream below to spawn. They could not get back to the lake as the water falls perpendicularly three or more feet from the outlet-flume into the stream below. So the whole family will probably take up quarters for the next season in Sand lake, a mile or more below. But if they get working down in this way they will eventually get into Lake Ontario, and I don't know why this will not be a good place for them. It has been contended, I believe by some, that the salmon which formerly ran up the streams from Lake Ontario did not come up from the sea but had their habitation in the lake. It may be that the land-locked salmon ran down and out of Woodhull lake because there are no suitable streams to run up; the inlets of that lake being too small, and, at the spawning season, too low to be available.

Very truly yours,

R. U. SHERMAN.

No doubt this fish will prove to be a valuable addition to the waters of the Adirondacks. Last fall Gen. Sherman sent a male of this species to Mr. E. G. Blackford, Fulton market, New York, also one of the board of N. Y. Commissioners, and I was fortunate in seeing it. It was a fish of perhaps three and a half or four pounds and had the prominent hooked-jaw of the male salmon at the spawning season, and also the highly colored sides which distinguish a ripe male salmon.

Under the title of "Lake Salmon," Mr. Everett Smith, a well-informed gentleman of Maine, writes as follows:

Forest and Stream of Feb. 15, gives its readers some interesting memoranda of the lake salmon (*Salmo salar*, variety *Sebago*, etc.), by Mr. Atkins, and the range of this fish in Maine is divided into "four districts," viz.: "Basin of St. Croix river, basin of Union river, Hancock Co., basin of Presumpscot river (Lake Sebago, etc.), and basin of Sebec river, a branch of the Penobscot." In connection with the latter district are the following remarks: "Not known to be found in

other parts of Penobscot basin. Singular that they have not spread all through the Penobscot. It has many lakes seemingly well fitted." The Penobscot river is a broad, shallow stream, with water very warm in summer (although cold streams are tributary to it), and is not of the nature to invite salmon or trout to abide therein. Many of the cold lakes tributary to this river are inaccessible to fish from the main river, else some of them might, by chance, become populated by stray salmon. But a salmon wandering from its home in a cold lake to the warmer and impure water of this river would quickly return whence it came if possible, or if barred out by obstructions, would incur capture by the persistency with which it would seek to return home. I have caught the lake salmon (variety *Sebago*) in the west branch of the Penobscot river. Perhaps the salt salmon of one to five pounds weight, occasionally taken in other portions of the Penobscot river, are all of the lake or *Sebago* variety. I believe that the "grilse" form has never been found, at least above tide water, in the Penobscot river, nor in any river in Maine, although both the "parr" and "smolt" are abundant.

The Rainbow Trout.

Salmo irideus. Gibbons. (*Irideus,* iridescent, rainbow-like.)

Synonyms.

California brook trout. Reps. N. Y. Fish Commission.
California mountain trout. Reps. N. Y. Fish Commission.
Salmo masoni. Suckley. Pacific R. R. Reps.
Salmo newberrii. Girard.
Rainbow trout. *Forest and Stream,* and anglers generally.

This fish, whose specific name of *irideus* or *iridea* is interpreted to mean "rainbow color," is easily distinguished from our native species by being black spotted and having a bright stripe running along its side, even when only a few inches long. When larger, its comparatively large scales alone would distinguish it. Its head is short and blunt, and its general appearance is that of fish somewhat coarser than our native brook trout. It was brought from California by both the United States and the New York Fish Commissioners, and introduced by the latter into the Fulton chain, Woodhull, south branch of Moose river, Bisby, Sylvia (St. Lawrence Co.), Oswegatchie river, Pleasant, Round, and some other lakes and streams. I have steadily opposed the indiscriminate introduction of this coarser fish into waters which are suited to our own native trout, believing that the latter is the better fish. It has been claimed for the rainbow trout that it grows faster and is gamier than our own. I am not yet prepared to believe

that it is gamier, and if it grows quicker it means that it consumes more food, and hence will drive out the native species as the European sparrow is usurping the place of our native song birds by its voraciousness, fecundity and pugnacity. I am of the opinion that the rainbow trout is a coarser fish than our native trout and not to be compared with it for the table.

THE BROOK TROUT.

Salvelinus fontinalis. Rich. Gill & Jordan. (*Salvelinus,* Ger. a small salmon; *fontinalis,* of the fountains.)

SYNONYMS.

Speckled trout.
Mountain trout.
Salmo fontinalis, Mitchell. De Kay.
Salmo canadensis. Smith.
Salmo erythrogaster. De Kay.
Baione fontinalis. De Kay.
Salmo immaculata. Storer.

The brook trout is deservedly a favorite among anglers. Its generic name is derived from "Salbling," a German word meaning a little salmon, and its specific name comes from "fountain," literally the little salmon of the springs. It belongs to the group of fishes known in England as "charrs," and which are distinguished from the true trouts by their finer scales, red flesh, and their dentition. The scales on our trout are barely visible when raised with a knife, unless the skin is first dried, when they can be easily seen. The principal differences between the genera *Salmo* and *Salvelinus* are: The former has a flat vomer (the longitudinal bone in the roof of the mouth which separates the nostrils and which can be felt in the human mouth by placing the tongue in the roof of the mouth just back of the teeth), while *Salvelinus* has a ridged vomer "somewhat boat-shaped (whence the generic name of *Cristivomer,* as applied to the lake trout). The vomer in Salmo has teeth in two alternating rows, or in one zigzag row, placed directly on the surface of the bone, not on a free keel-like crest. The shaft of the vomer in *Salvelinus* has no teeth, there being only a small patch of them at its forward end. The different species of *Salmo* are black-spotted, while *Salvelinus,* except the lake trout, is red-spotted. Our brook trout differs so greatly in coloration that it has been described as several species. In Canada and New Brunswick it loses its red spots in salt water and becomes "salmon trout" and sea trout;" but the young of these fishes, when bred in fresh water, are colored like our brook trout, and they are the same fish. The

South Side Sportman's Club of Long Island, has them in their ponds, from New Brunswick parents, and they cannot be distinguished from the common brook trout. This shows how little value the color of fishes has in determining their species.

The brook trout is inclined to migrate and will go to sea if no obstructions exist in the shape of dams or unsuitable water which confines it. On Long Island the trout run down into salt water and attain an excellence as food that inclines New Yorkers to think, and I agree with them, that Long Island trout are the finest in the country. The range of the brook trout is from the Arctic regions as far south as the water is cold enough for it. This is, in the south only on elevated regions, along the slopes of the Alleganies. It is found in most Adirondack waters. My correspondents inform me that it is not found in T lake, a tributary of the east branch of West Canada creek; Metcalf lake, a tributary of the north branch of the same; Spectacle, Dexter, Spy, Oxbow, Midriffs, Coal, Scuts, Willis, Murphy, Warner, Remsen and Bug lakes, Long and Chub ponds, Partlo brook (St. Lawrence county, not the lake of that name in Herkimer county), and that it was not known in Bisby and the small lakes above it until 1879, when they were stocked by the New York Fish Commission.

The Lake Trout.

Salvelinus namaycush. (Walb.) Goode. (*Namaycush*, an Indian name.)

Synonyms.

Salmon. Adirondack guides.
Salmon trout. Parts of New York.
Mackinaw trout. Michigan.
Togue and Lunge. Maine and Vermont.
Winnipiseogee trout. New Hampshire.
Salmo namaycush. Block.
Salmo amethystus. Mitch. De Kay.
Salmo confinis. De Kay.
Salmo symmetrica. Prescott.
Salmo toma. Hamlin.
Salmo adarondackus. Norris.
Cristivomer namaycush. Gill & Jor. Manual of Vertebrates, 1880.

This species is gray-spotted, the spots sometimes tinged with red. Its caudal fin is deeply forked. The teeth on the vomer are not directly on the shaft but on a raised crest (see preceding species). They require colder water than the brook trout, and in summer they are

only found in the deeper waters of those lakes which have a depth of forty or more feet, and have large springs at the bottom. The lake trout is not much of a favorite with anglers because it must be fished for in such deep water, and its fighting qualities are inferior to those of the brook trout.

The "salmon" of the Adirondacks, which one hears of so much here is simply the lake trout, sometimes called salmon-trout, and often the first part of the name only is used. I heard a man try to make a distinction between brook trout which live in lakes and those which inhabit the inlets or brooks. He termed the latter brook trout and the former "lake-brook-trout" in his argument to sustain his position that there were two species, or rather to maintain that "lake trout" was an indefinite term and meant any trout which was found in a lake. He did not succeed very well after a guide asked him to describe his lake-brook-trout so that it could be distinguished from the ordinary brook trout, and suggested that a deer was the same animal whether found on the mountains or in the lakes. A lake trout of 27¼ pounds, from Raquette lake, is credited to Alvah Dunning, the guide, who sent it to the Superintendent of the Adirondack railroad. It was taken July 2, 1879.

Most people agree on the excellent table qualities of the Adirondack lake trout. They are a fine fish, and I prefer them to the brook trout for the pan. In the spring, while the water is cool near the shore, these fish take the fly, but in summer they must be sought in deep water, for of all their family in America they are most sensitive to warmth and die soonest from it. The salbling, or German charr, is probably as sensitive, and these waters would suit it very well. The fish would also suit the waters, as it is a lake trout of large size with a beautifully colored crimson side and belly, and a fine table fish. The native lake trout of this region can be distinguished from those planted here by the commission from parents in Lake Ontario, by their color. The skin is darker and the flesh redder, yet ichthyologically they are the same fish. One would think the strangers, having been placed here in babyhood, would assume the characters of the natives. I had no chance to test their comparative table qualities.

Gen. Sherman, of the N. Y. Fish Commission, writes:

NEW HARTFORD, *Sept.* 4, 1882.

FRED MATHER:

Dear Sir: — Your letter of the 22d has been on my table some time, but as I have been absent from home a good deal of late, the right time to answer it has not occurred till now.

I regret that you and Mr. Colvin could not have taken in the Bisby

lakes in your summer's explorations, as I am sure you would have seen much in that region to interest you. Mr. Colvin made us a flying call of a few hours, but I was not in the woods at the time, so I missed the pleasure of his visit. I hope that some time next year I may meet you both on ground so congenial to us all.

In answer to your inquiry about the presence of eels in the Bisby lakes, I have to say that in 1878, I saw a large silver eel in the upper Bisby. I was fishing with a companion in May on a sandy shoal, for salmon trout, at a place they much frequent at that time of the year. My companion, who had a fly rod with a small piece of chub for bait, hooked a large fish which doubled up his rod. After playing him for a long time without tiring, he brought him near the surface. I was standing on a rock with him at the time and stepped into a boat to assist him land the fish. We had no landing net, so I took hold of the line to see if I could lift the fish in, when he broke loose just at the surface. It was an eel full three feet long and of a bright silvery color. He wriggled out of sight in a couple of seconds. That is the only eel I have ever known of in the lake, but I have heard an old guide say he had known of others. The first or upper Bisby flows into the second, and the second into the third. Below the third is a ledge of rocks on which the water falls from a height of sixty feet. If the theory is correct that eels are only produced in brackish water, this specimen, when small, must have wormed his way up this rock. The third Bisby now flows by an artificial outlet into Mud lake. The natural outlet is the fourth Bisby. By either course the water eventually reaches the big Woodhull and flows thence into Black river.

I heard some years ago that a large eel (weight 15 lbs.), had been caught in Mud lake. An Irishman, on whose line he was hooked, told me of it. He had the inherited dread of his race of the reptile kind, and when he saw the eel coming into the boat with open mouth, he jumped out and swam ashore, leaving his companion to save the fish, which he did.

The smaller lakes at the head waters of the Black river and West Canadack, do not have suckers; at least I have never seen or heard of them in those waters. The larger lakes flowing into the Black river, Woodhull, South lake and Canachagala (which now flows into Black river, though formerly into the south branch of Moose), all have them. I have never examined them particularly, but think they are the ordinary white suckers. Where they abound they are the principal food of the large salmon trout, and with this food they attain great size and extraordinary fatness. I know of twelve fish having been taken by one party at South lake, the aggregate weight of which was over 300 pounds. These were taken on sixteen-hook gangs baited with

suckers, of one-quarter to one-half pound weight, on long lines with heavy sinkers, carrying the bait near the bottom.

Mr. Colvin left a request at Bisby when he was there to have specimens of the salmon trout of that lake bottled in alcohol for your use. I was unable to do this on my last visit for the reason that I had no suitable jars. If you want the fish this fall I will send in the jars; or, if there is no hurry, I will put them up myself when I go in again. We put in second Bisby two years ago last spring 20,000 salmon trout spawn from ova taken in Lake Huron. We caught in June and July last quite a number of fish from this stock, generally of about one-half pound weight. They are readily distinguishable from the trout native to the lake, being longer in body, brighter in color and with finer spots. Their flesh, like that of the native trout, was *white.*

I have not visited the survey station on Woodhull mountain and am therefore unable to give the description you request for *Forest and Stream.* I shall take this in on my next spring's trip.

The small fish in Bisby are dace, and a little red-striped fish looking in form like a mackerel. There are no shiners, as in the Fulton chain. In the outlet of Canachagala are the red-fin shiners.

Yours truly,

R. U. SHERMAN.

NEW HARTFORD, *Sept.* 22, 1882.

FRED MATHER:

Dear Sir: — You are quite welcome to use any material you may find in my last letter or any other, that may be of service in your report. I regret that I have not such a technical acquaintance with fish lore as would make my contributions more useful.

If I should be able to go to Bisby next month I will collect specimens of the small fish and send you. As the salmon trout are now big with spawn, the time is not as good to secure fine specimens of them as the spring and earlier summer would be. I should think it would be desirable to have specimens from many different lakes as the fish of each lake has its peculiarity of form and marking, though all belong to the same general family. The fish of the upper Bisby, for instance, have black or dark green backs and are silvery underneath, while the fish of the second lake, situated but a few rods distant from the first and connected with it by a water passage, are brownish in color and shorter in form than those of the first lake. And what may seem singular to one not up in fish lore is, that the fish of neither lake are ever found in the other. Each sticks to its own native water like a cat to its native garret. The fish of both these lakes are a delicate white

in the color of their flesh, and herein differ from any other salmon trout I have seen. You will notice the same variations in color in the salmon trout of the Fulton chain. The trout of the first lake are white in color; of the third dark brown; and of the fourth black and silver. Any one who has done much fishing in these waters can readily distinguish at sight the fish of either lake.

The trout from Lake Huron spawn, as far as I have observed them, retain their bright silver color, and in the Bisby take to the delicacy of form and acquire the white color of flesh which distinguishes the native trout.

I should think a notice of the fish food of our northern waters would form an interesting chapter of your report. The food, as you know, has a very marked influence upon the appearance and quality of the fish. I found in a small lake called "Count's lake," flowing into the south branch of Moose river, last summer, the fresh water shrimp. I presume it is in other waters of this region, but I have not seen them elsewhere. Water bugs in infinite variety, abound in Count's lake, and indeed in all the wilderness waters, and are found in greatest abundance, in waters that have much vegetation at the bottom. The Caddis family are very numerous, and during a period in June are the food principally sought by the trout. The crayfish is found in the upper Bisby and I presume exists in most of the lakes, though not in the abundance in which it is found in waters impregnated with lime. I have never seen the Miller's thumb or the Helgramite in any of the streams or other waters of the wilderness, though the Moose river and its branches are well adapted to the Miller's thumb.

I found last summer in a speckled trout of 4¼ lbs. weight, caught in lake Canachagala, about 100 spawn, well developed and of full size. I heard of another caught a few days before that contained a similar collection. This was in the month of July. These could not have been of this season's formation. I take it they were what remained uncast of last year's ova, which, perhaps from the absence of the male fish, had not been cast. Yours truly,

R. U. SHERMAN.

MR. FRED MATHER: *September* 4, 1882.

Dear Sir:—We put in Bisby lake two years ago 20,000 lake trout from spawn taken in Lake Huron. We caught in June and July last quite a number of fish from this stock, generally of half a pound weight. They are readily distinguishable from the trout native to the lake by being larger in body, brighter in color, and with finer spots. Their flesh, like that of the native trout, was white.

Yours truly, R. U. SHERMAN.

THE FROST-FISH.

Prosopium quadrilaterale (Rich.) Milner. (*Prosopeia*, a mask.)

SYNONYMS.

Coregonus quadrilateralis. Richardson.
Coregonus novæ-angliæ. Prescott.
Whitefish. Northern Adirondacks, Meacham lake, etc
Shad-waiter. New Hampshire.
Round whitefish. Jordan, "Man. Vertebrates."
Menomonee whitefish. Northern Wisconsin. Milner.
Chateaugay shad.
Lake Champlain shad.

This fish is one of several species generally called "whitefish," the type of which is the large fish of that name found in the great lakes. I took them in Big Moose, the Fulton chain and Clear pond (near Meacham lake). They are a handsome fish and most excellent for the table. They do not take the hook, and are usually captured in the fall while running up the brooks to spawn, when they are taken in great numbers by traps made of stakes, and are salted for winter use by those living in the woods. They are classed in the same family with the salmon and the trouts, although they have no teeth and have large loose scales. The presence of the small adipose second dorsal fin and other common characters, seem sufficient to place the genera *Coregonus, Argyrosomus* and *Prosopium,* the whitefishes and so-called lake herrings; *Osmerus,* the smelts, and *Thymallus,* the graylings, in the family *Salmonidæ.*

Description of the "frost-fish."—Length, 10 inches; depth in length, 5; head in length, 5; eye in head, 4½; longest dorsal ray in head, 1½, formula of fin-rays; dorsal, 11; anal, 10; ventral, 10; pectoral, 15, branchiostegals, 7. Shape: long, slender and somewhat four-sided (hence *quadrilateralis*); mouth small, upper jaw longest; maxillary short and small, equal to orbit but not reaching it; teeth, none; scales moderately large, 83 to 88 in lateral line, nine rows above and seven below lateral line. Fins: dorsal four inches from nose, the adipose dorsal four inches from the first; anal with its middle under the adipose dorsal; ventrals inserted under middle of dorsal; pectorals low. Color silvery with coppery tinge on the sides.

According to Jordan, "Manual of the Vertebrates," this fish should have fourteen rays on its dorsal fin and thirteen in its anal. I cannot refer the frost-fish to any other species, and do not feel warranted in

differentiating it from *quadrilaterale* on account of a difference in its fin-rays.*

I saw a frost-fish in alcohol in the possession of Mr. A. R. Fuller, of Meacham lake, which looked as though it might weigh nearly two pounds. The average weight seems to be from three-quarters to one pound.

Mr. Fuller has hatched some of these fish and has attempted to cross them with the brook trout. He writes :

MEACHAM LAKE, FRANKLIN CO., N. Y.,
December 12, 1882.

MY DEAR MATHER:

In regard to the whitefish eggs and trout eggs impregnated with whitefish milt, I am not very sanguine of success with either, and had hard luck in getting both sexes. One day it was all females ; the next all males, and neither would live two hours after being taken from the net. I have not seen the eggs for a week. When I last saw them I had my doubts of either being good for anything ; but this has awakened the desire to experiment farther. Next year I will get some kind of a net that will not injure the fish, then take them to the hatching-house and wait for them as I do for the trout. The whitefish are so late I had to pull the net out before I got many spawners.

On November 27, I took the net out and had to break ice the whole distance from the boat-landing to the net. That day I got two whitefish, females, and one female trout, all full of eggs, and had no male; the day before I put a male whitefish in my box, but he was dead when I looked for him.

A. R. FULLER.

FAMILY CYPRINIDÆ.

Kuprinus, a carp.

This family is included in the sub-order *Eventognathi*, or the carp-like fishes, *i. e.*, fishes usually having the head naked and the body scaly, a single dorsal fin composed entirely of soft rays, usually less than ten ; margin of the upper jaw formed by the intermaxillaries alone ; lips less developed than in the *Catostomoids* (suckers) ; mouth toothless ; air bladder usually large and usually divided.

This is one of the most difficult of families to work in because there are over a hundred genera and nearly a thousand species. These

* Since this was written Messrs. Jordan and Gilbert have published their "Synopsis of the Fishes of North America," and in this work, p. 298, their fin formula agrees with my enumeration.

grade into each other in a manner very confusing to the student, and the lines of separation, however well marked they may appear between two specimens, are sure to be encroached upon by intermediate ones. In the old world there are several species of this family which grow to good size and are recognized as game fish. In America there is but one species which grows to a size that entitles it to the notice of the angler. This is the "big chub," "fall fish," "roach," etc. *Semotilus bullaris* (Raf.) Jordan. The other members of the family are lumped together in the popular nomenclature as chubs, dace, shiners, and that name which covers a multitude of fishes, "minnows."

SHINERS.

Luxilus cornutus. Mitch. Jor. (*Lux*, light; *cornutus*, horned.)

SYNONYMS.

Red fin. Males in spring, or breeding, dress.
Shiners. Females, and males in autumn.
Luxilus diplemius. Kirtland.
Leuciscus cornutus. De Kay.
Cyprinus cornutus. Mitch.
Plargyrus typious. Girard.
Minnitus cornutus. (Raf. Mitch.) Jor. & Gil.

This is a very common fish in most Adirondack waters. It runs into the streams in June to spawn, and then the males are exceedingly brilliant. Their length is about five inches, and the sexes are so different in appearance at spawning time as to be taken by many for two different fish. It was only by opening many specimens that I convinced a dozen or more of the guides that they were male and female, showing them that while eggs were always present in their "shiners," the "red-fins" were always filled with milt.

The fish may be readily recognized by the apparent diamond-form of its scales, their exposed surfaces taking the shape of being higher than long. The dorsal fin is higher than long and is composed of one entire and seven branched rays; it is situated above the ventrals. Colors: Dark brown, or steel blue above, with metallic opercles; fins plain except males in spring. Females silvery. Males in breeding dress with lateral and vertebral bands of gold or bronze; head, at this time, covered with small pointed tubercles which extend along the sides and back and are afterward shed; fins bright red, which also appears on the belly and the throat; lower jaw shortest; air-bladder double.

I have taken this fish with the artificial fly quite freely when in the streams at spawning time. It is no doubt a valuable fish in connec-

tion with trout, as I have taken large trout with this fish in their stomachs.

RED BELLIED DACE.

Chrosomus erythrogaster. Agassiz. (*Chros,* color ; *soma,* body ; *eryth,* red ; *gaster,* belly.)

A beautiful little fish much like the black-nosed dace, *Rhinichthys atronasus,* in general appearance, only it has two stripes instead of one. Its pharyngeal teeth have a grinding surface which the latter has not and also in other distinctions apparent only upon close examination. It is a fish that scarcely reaches three inches, and is slender and graceful. Its color is a dark olive with a dark band starting from above the eye and continuing around the tail, while a similar band, starting in front of the eye and running through it, follows the upper one in a parallel line. The space between these bands is silvery ; but in the spring it is a bright scarlet in the males. The belly is yellow, and it is a most elegant little fish. Fin formula: D. 1, 8; A. 1, 9. Found in Little Moose lake July 1, spawning in the small streams. We took a couple of quarts of them to the Forge House and had them fried without cleaning. They were very bitter, a fact that I attributed to the eggs ; if they had been opened and the eggs taken out, they might have been better. It may not have been the eggs but the intestines and their contents which made the bitterness ; but one of the guides remarked "You might know they'd be bitter from the yellow bellies." They were spawning on July second.

HORNED DACE.

Semotilus corporalis (Raf. Mitch.) Putnam. (*Sema,* a banner ; *tilus,* supposed to mean a spot ; *corporalio, the corporal.*)

SYNONYMS.

Chub. Generally.
The corporaalen. De Kay.
Leuciscus corporalis. De Kay.
Cyprinus corporalis. Mitch.
Semotilus atromaculatus, etc. Auct.

This is the largest of the Adirondack cyprinoids, unless the following species is found to exist here. It derives its most common name of horned-dace from the fact that the male usually has its head well covered with large horny tubercles which are deciduous. I found it abundant everywhere and often took it with the artificial fly. This fish may be distinguished by its large head and the peculiar dorsal spot. (Jordan.) Head, 5 in length ; depth, 4½. Fins, red in spring ; dorsal I, 7; A. I, 8; scales deeper than long ; smaller anteriorly. Dorsal be-

hind ventrals, mouth terminal, upper jaw slightly longest. Opercles large, smooth; caudal-forked. Sides bluish, shading to yellow below. Common.

FALL FISH.

Semotilus bullaris (Raf.) Jor. (*Bullaris*, bubling.)

SYNONYMS.

Dace. Roach in different States.
Silvery dace. De Kay.
Leuciscus argenteus De Kay. Storer.
Leucosomus cataractus. Baird.
Semotilus rhotheus and *S. pulchellus.* Auct.

I do not know that this fish inhabits the Adirondacks, and insert it on the strength of the following letter from Capt. L. A. Beardslee, U. S. N.:

LITTLE FALLS, N. Y., *Nov.* 26, 1882.

Mr. F. MATHER:

Dear Sir: — Piseco lake is, or was five years ago, infested by "Mohawk chubs," which lie in just the waters that big trout like, and used to rise and strike at any thing that a trout will. They have utterly ruined trolling in the narrows and across some bays, for a chub of from one to three pounds is sure to strike every spoon at about the same time. These fish are descendants of a pail full of minnows that some twelve years ago were carried to the lake by men who fished through the ice and threw in their surplus bait, hence these chubs which average much larger than in their native river.

Yours truly,

L. A. BEARDSLEE.

As the fish named is the largest of our cyprinoids, I infer that the fish mentioned by Capt. Beardslee is this species. It is reckoned among the game fishes by many. Its head is smaller than the preceding species and it has not the dorsal spot. It is usually found below rapids, hence the name of "fall fish."

LAKE CHUB.

Couesius prosthemius. (Cope) Jordan. (*Couesius*, Dr. Coues (?); *prosthemius*, something added.)

SYNONYMS.

Morse lake minnows. Adirondack guides.
Seventh lake minnows. (Fulton chain) guides.

Ceratichthys prosthemius. (Baird) Jordan.

I record this species with some doubt. Not feeling confident that my diagnosis was correct, I sent the fishes to Prof. Jordan who had kindly offered to help me out of any deep water that I might get into. This gentleman, one of the first of ichthyologists, seemed also in doubt about them, owing to their very ripe condition, which was caused by our being absent two days in June before the fish reached the alcohol tank. Unfortunately this was the case with several of our specimens as it is very inconvenient to take the copper tanks furnished by Prof. Baird, or even fruit jars, over the carries along with the other impedimenta. Prof. Jordan wrote me as follows :

Indiana University, Bloomington, Ind.

Mr. Mather :

Dear Sir: — These fishes are so much decayed that I cannot say certainly what they are. Possibly new. To the best of my guessing ability, they are *Couesius prosthemius* (Cope) Jor., but the teeth seem to be as in *Ceratichthys* rather than in *Couesius*. They are very mellow now.

Cordially yours,

DAVID S. JORDAN.

Not caring to needlessly multiply species I accept Prof. Jordan's "guess," and append the following description from his " Manual of the Vertebrates," with the explanation that where teeth are spoken of in all *Cyprinidæ* the pharyngeal teeth are intended, this family having no teeth in the mouth. "Teeth without grinding surface ; dorsal fin beginning over, slightly before or slightly behind ventrals ; head not flattened. Nocomis" [Ceratichthys]. Again he gives the generic character of *Ceratichthys* [*Nocomis* Grd.] as " mouth terminal, large ; teeth 4–4 (sometimes 1, 4–4, 1;) size large ; dorsal over ventrals." After enumerating several species we come to *C. prosthemius,* Cope, of which he gives the following as specific characters : " Depth, five in length, equal to length of head ; eye, four in head ; snout blunt ; mouth small; dusky above, sides plumbeous ; lateral line sixty-three [scales ;] length six to seven inches. Great lakes."

I do not know this fish and have not Prof. Cope's description. That of Prof. Jordan, given in full above, is too meagre to permit me to decide whether it applies to this fish, or if it be a new species.

Nosey.

Rhinichthys cataractæ. (Cuv. et Val.) Jordan. (*Rhin.* the nose; *ichthys,* a fish).

SYNONYMS.

Long-nosed dace. Jordan.
Long snout minnow. Guides.
Rhinichthys nasutus. (Ayres) Agassiz.
Rhinichthys lunatus. Cope.

This small fish would attract attention from a casual observer by its long, soft and flexible nose. Description: Length, 2¾ inches; depth in length 6, head 5, eye in head 3. Fin formula D. I, 7; A. I, 6; V. 7; P. 11. Scales rough, roundish near head and elongate near caudal, 62 in lateral line; 12 rows above and 10 below; mouth inferior; lower jaw shortest, nose fleshy. Fins: Dorsal inserted just back of ventrals, high, third ray longest; anal deeper than long, third ray longest; ventrals, third longest. Color: dull brown on back, dull brown stripe on side, belly dirty white. Locality, Fourth lake, Fulton chain.

BLACK-NOSED DACE.

Rhinichthys atronasus (Mitch.) Ag. (*Atro,* black; *nasus*, nose.)

SYNONYMS.

Leuciscus atronasus. De Kay, Storer.
Argyreus atronasus. Heckel.
Cyprinus atronasus. Mitchill.

I did not meet this fish in the wilderness. The only specimens seen I took from 14th creek, near the village of North River, a tributary of the Hudson, 4th lake Fulton chain, and Moose river. It is found in most of the tributaries of the Hudson river as low down as the city of Hudson, or below. I never saw one over 2¼ inches long, and the black stripe on its side which runs through the eye and around the nose gives it its specific name. It is a lively fish, usually in swift water, but thrives in the aquarium. Description: Depth in length, 5½; head in length, 4; eye in head, 4. Scales: 65 in lateral line, 11 rows above and 8 below. Fins: dorsal higher than long, rays I, 8; anal, first and second rays longest, I, 7; ventrals in advance of dorsal, 8; pectorals fan-shaped, 10; branchiostegals, 4; pharyngeal teeth, 1, 4–4, 1; opercles smooth; color variable, dusky with a dark lateral stripe which runs around the nose; this is a bright crimson in the spring, fading into orange in the summer and changing to black in autumn. The specimens taken in "13th Pond" stream, near North river, Warren county, June 18th, had a black stripe, ; those captured in Moose river, June 30, had a red stripe. The belly is silvery. They prefer streams to lakes.

FAMILY CATOSTOMIDÆ.

The Suckers.

This family was formerly included in the *cyprinidæ* because they had soft fins and no teeth. They are popularly known as "suckers" on account of their protractile, fleshy mouths, which are more or less inferiorly situated, and being toothless, are used to gather both animal and vegetable food from stones or mud. This mouth separates them from the cyprinoids. There are about twelve genera and fifty species, and they are almost peculiarly American; only one species being known in China and one in Siberia. The scales are usually large and the air-bladder is double or triple. Some Western and Southern species grow to a large size and are much used as food, especially in the spring of the year, when the waters are cool. In the Adirondacks they are of value as food for other and better fishes.

I found what I believe to be four species belonging to one genus, *Catostomus*, and saw some in breeding dress in the Fulton chain inlets in the latter half of June, which I could not capture, but which I think, from the bright red on their sides, were the same as some taken in deeper waters and described as *C. longirostris*. I say that I believe that I found four species, because, while I have been able to identify two of them, I have, after long and patient searching of the works of better ichthyologists, failed to find descriptions of two of the suckers collected, and therefore think them new, and as such will describe them after the two which I have identified. The genus *Catostomus* is distinguished from other suckers by fine scales crowded anteriorly, small mouth placed low, and thick papillose lips.

Long-nosed Sucker.

Catostomus longirostris. (Le Sueur.) (*Kata*, low; *stomus*, mouth; *longirostris*, long snout.)

Synonyms.

Red sucker, in breeding season.
Black sucker, at other times in the Adirondacks.
Long-nosed sucker, generally.
Northern sucker, Jordan and Gilbert.
Cyprinus catostomus, Forster, Phil. Trans. 1773.
C. fosterianus. Richardson.
C. hudsonius. Le Sueur.
C. griseus. Grd. Gunther.

This species is common in most Adirondack waters and is readily distinguished by its long nose. It grows to a length of fifteen inches

and a weight of a pound and a half in these cold waters, but it is a much larger fish farther south. It is more slender in the Adirondacks. The following description of a typical Adirondack fish, as recorded in my field notes, is compared with the description given by Jordan and Gilbert (Synopsis of the Fishes of North America, Bulletin of the United States National Museum, No. 16, Washington, 1882). Where my measurements differ from those authors their figures are given in brackets. Length, 10 inches; depth in length, $6\frac{1}{4}$, [$4\frac{1}{4}$, $4\frac{3}{4}$]. Head, 4 in length, [$4\frac{1}{4}$, $4\frac{2}{3}$]; eye in head, 6; eye in snout, 3; scales in lateral line, 99, [99, 114]; scales above lat. l., 13; below lat. l., 15; rays in dorsal fin, 8, [10 or 11]; rays in anal, 6; shape cylindrical, mouth inferior and large, lower lip bi-lobed, upper narrow, both tuberculated; scales small and crowded anteriorly; head with long tapering snout, smooth; dorsal fin square, anal deep, ventrals moderately large, pectorals long, reaching to insertion of dorsal, caudal slightly forked.

De Kay does not include this fish in his Fishes of New York, but mentions it as occurring in Vermont, on the authority of Le Sueur and Richardson.

COMMON SUCKER.

Catostomus commersoni. (Lacepede.) Jordan. (*Commersoni*, name of naturalist.)

White sucker.
Brook sucker.
Fine-scaled sucker.
Catostomus communis, De Kay; Fishes of New York.
C. *teres*, *bostoniensis*, etc., of authors.

This is the most common sucker of eastern North America. Its range is given by Jordan, as "All streams from Labrador to Montana and southward to Florida." It is so very variable in its appearance that a specimen taken in Big Moose lake puzzled me until assured by Dr. Bean of its identity. Ordinarily, this fish is round-bodied and plump, but the Big Moose specimen was flat-sided, flabby, its scales very loose, and its color a dirty white on the sides instead of silvery. *C. commersoni* is a cylindrical, tapering fish, with a large mouth placed well forward. Rays in dorsal fin, 1–13; anal, 7; ventral, 9; pectoral, 17; length, 15 inches; color, olive-brown above, shading to silvery white below in adults; young, brownish; males with a light pink band along the sides in spring.

In November I saw three suckers at play on the surface of the water of Meacham lake in the evening, appearing at a little distance as though rising at flies, but this was not the case for they were in schools and chasing each other. Their backs would be above the surface for

some seconds, and I shot several with a shot gun and captured them for identification.

The June Sucker.

Catostomus utawana. Sp. novo. (*Utawana,* name of lake.)

This small fish I was at first disposed to consider as a dwarfed mountain form of *C. commersoni*, but the fact that the latter fish is found in waters inhabited by this species, and while it grows to a length of twelve or more inches there, this little sucker barely reaches five. Added to this the fact that the larger species had finished spawning in the inlets in May, while this fish was found in masses in the swift cold mountain streams which tumble rapidly over rocks in the latter part of June, depositing their eggs, thereby showing that they are adult fish.

Description : Body elongate and but little compressed, heaviest at shoulder and tapering to tail, nearly cylindrical; head moderately large, sub-quadrate, much flattened above ; its length in body, 4 ; snout very slightly prominent; mouth nearly terminal, protractile upper lip with two rows of papillæ and continuous with the lower; the latter bi-lobed and strongly papillose; scales crowded anteriorly but not larger in the lateral line than those below ; 67 in lateral line, nine rows above and eight below ; lateral line straight, faint, obsolete in spots; length, exclusive of caudal fin, 4½ inches; eye in head, 4 ; eye in snout, 2 ; inter-orbital space in head, 4. Fins: Dorsal square, inserted in middle of body ; rays, 1, 11 ; its height equals its length. Anal: 5 rays, third longest, reaching to base of caudal ; this ray is 2¼ times the length of the fin. Ventrals inserted under fifth dorsal ray, 9 rays, third ray three times the length of the fin. Pectorals: 15 rays, reaching nearly to the insertion of dorsal ; caudal deeply forked; lobes equal; pharyngeal bones moderate; lower two teeth enlarged and truncate. Color: olive above shading into white ; males without red color on sides at breeding season ; can only be distinguished by their smaller size and slender bodies.

On June 23, I found these fish in a little cold turbulent mountain brook emptying into Minnow pond, one of the tributaries of Blue Mountain lake. Three days later I found them in a stream of similar character which empties into the North bay, Big Moose lake. In the latter stream there were but few fish, but their eggs were so plentiful that it was evident that their season was nearly over and that most of the fish had returned to the lake. Both this species and the next are never seen except when spawning. I have named it from one of the lakes in the Blue mountain chain where it may probably be found. Utawana is an Indian name meaning sunshine, and while the trans-

lation may not be appropriate to a fish which inhabits deep water all the year, except for about ten days in the breeding season, and then seeks shady woods, it is a good sounding name and one that no other fish bears, two reasons that seem to me to outweigh any other objection.

THE DWARF SUCKER.

Catostomus nanomyzon. Sp. novo. (*Nanos,* small ; *muzo,* to suck.)

This fish was found in a little mountain brook emptying into Big Moose lake nearly north of the Big Moose club house, by a bark shanty known as "Pancake Hall." I reached the lake on June 26, and only found four specimens while looking for bait for lake trout. The fish were spawning, and by the number of eggs under the stones, it was plain to be seen that there had been a big run of fish in the brook some days before. As the fish were unknown to me they were not used for bait, and, as in the preceding species, they were kept long before they were declared to be new.

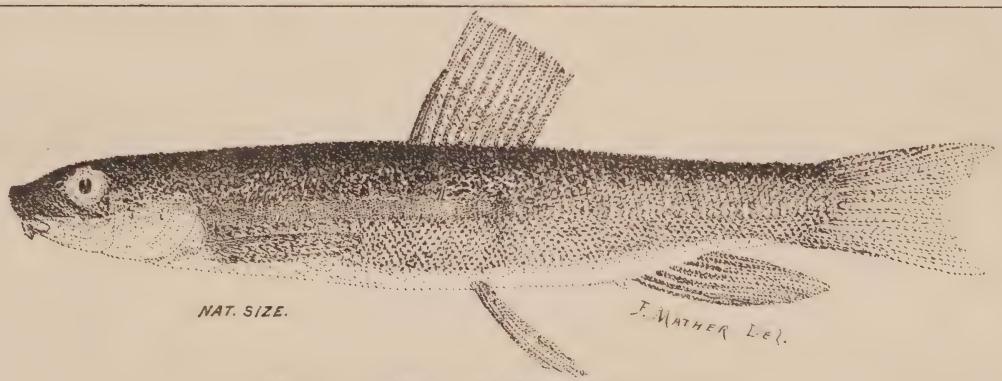
Description : Body elongate, subterete, the depth $5\frac{1}{2}$ in length ; head long and slender, 4 in length, depressed and flattened above. broad at base and tapering into a moderately long snout, which is not as long in proportion as in *C. longirostris,* which this species somewhat resembles ; mouth well forward ; lips thick, the lower coarsely tuberculate, and the upper with three or four rows of tubercles ; eye large, 4 in head, $1\frac{1}{2}$ in snout, placed forward of middle of head ; scales loose, minute forward but not crowded, larger behind, 99 in lateral line, 14 rows above, and 10 or 12 below ; lateral line indistinct, obsolete in middle. Fins : Dorsal square, higher than long ; rays 1, 10, the first or hard ray about one-half the length of the second ; anal reaching past insertion of caudal, 7 rays, 3d, longest and widest ; ventrals inserted under middle of dorsal, 9 rays ; pectorals long, reaching to 1st dorsal ; caudal long and forked ; no tubercles on head ; length $4\frac{1}{4}$ inches. Color : In breeding season, female brown with white on belly ; male with red stripe on side.

FAMILY SILURIDÆ.

Sialis, plump ; *oura,* a tail.

THE CATFISHES.

General characters : Skin naked and eel-like, covered with mucus; barbels on both jaws, four on each ; an adipose second dorsal fin as in *Salmonidæ ;* head large, flat and wide ; a sharp spine in the first rays of dorsal and pectoral fins ; in the latter, they can be set like a trig-



CATOSTOMUS NANOMYZON. *Sp. novo.*

CATOSTOMUS UTOWANA. *Sp. novo.*

Heliotype Printing Co. 211 Tremont St. Boston

ger, yet all the fins are soft-rayed. They are never found in swift waters, but prefer sluggish ones with muddy bottoms.

The Bullhead.

Amiurus catus. (Linn.) Gill. (*A*, not, *meiouros*, notched [the tail] ; *catus*, a cat, from the barbels.)

Synonyms.

Catfish. Pennsylvania and generally, as it is one of the family.
Bullhead. New York.
Horn-pout. Massachusetts.
Bull-pout. Connecticut and other parts.
Small catfish. Jordan.
Bullplug. Meacham lake.
Pimelodus atrarius. De Kay.
P. nebulosus. Le Sueur.

This is the only species of catfish which I found in the Adirondacks, and while there was no difficulty in identifying it with the species inhabiting the Hudson, there seems great difficulty in distinguishing between the published descriptions of *A. catus* (Linn.) Gill, and of *A. melas* (Raf.) Jordan. My specimens taken in 4th lake of the Fulton chain, and in Meacham lake and Clear pond near it, agree with descriptions of *A. catus* in all respects, except in the anal fin, the differences in which will be noted in the description. Contrary to the general opinion, this fish is often found in clear, cold, spring lakes ; but I incline to think that a muddy bottom in some part of the lake is necessary to their welfare. They guard their nests, and for some days after the young are hatched, one parent swims under the school of young. I took specimens in 4th lake, Fulton chain, and in Clear pond near Meacham lake. The family is characterized by a naked eel-like skin, large head, more or less flattened, and with eight barbels, the longest pair attached to the upper corners of the mouth or rudimentary maxillary. An adipose dorsal fin, as in *Salmonidæ*. Air bladder double, but enclosed in an opaque sac, which when stripped back, shows two distinct portions, each of which has a smaller construction. Fin rays soft with a stout pungent spine in the dorsal and ventrals. In the latter fins these spines can be set at right angles to the body and locked so that they may be broken before they can be pressed down. There is a sort of trigger-bone behind these ventral spines which, if touched, allows them to be laid back. In former years, when inspecting the commercial fisheries on the Hudson, I discovered this and the knowledge was of value in getting a "bull-head" from a gill net where it was entangled. The species found in Adiron-

dack waters differ slightly from some descriptions of *A. catus* and *A. melas*, as before mentioned. My field notes give the following:

Description: Body elongate and tapering depth, 4½ in length; head large, broad and depressed, 3¼ in length; eye in head 7½; mouth large, as wide as head; teeth villiform, on jaws alone; caudal fin not forked; color, black; anal fin contained 5 times in length. Fin rays: dorsal, 1, 5; anal, 17; ventral, 9; pectoral, 1, 6.*

A very common question in New York is: "What is the difference between a catfish and bullhead?" To this I usually answer that there are some twenty-five species of catfish in our fresh and salt waters, and the common pond catfish of the State of New York is popularly called a "bullhead." The popular saying that "a catfish has a forked tail and a bullhead a square one," is not literally correct. The species above described has a tail (caudal fin) cut nearly square (sub-truncate), and so have other species, while the shape of this fin varies in different species from a convex through truncate and emarginate to deeply forked. As a food fish, I place this fish very high, always preferring it to brook trout, and only second in the rank of Adirondack fishes, my choice being the frost-fish, *P. quadrilaterale*, as first, if the eel be not counted in as common enough in the woods to be a food fish in which case the "bullhead" would stand in the third rank. "If this be treason make the most of it."

FAMILY ANGUILLA.

THE EELS.

The general characters of this family are so well known that a description of them here is not necessary. Nor need we consider those members which live in the sea almost entirely, such as congers and others. These fishes are found in all countries except in the arctic regions. The family belongs in the order *Apodal* (footless, *i. e.*, no ventral fins).

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* Jordan gives: *A. catus;* anal 21 or 22; *A. melas;* (Man. of Vert.) 18 or 20, (Synop. N. Y. Fishes) 17 to 19. Gunther, Catalogue Fishes Brit. Mus., gives *A. catus* anal, (19) 22, 22. De Kay, Fishes of New York, gives *P. catus* D. 1, 6; P. 1, 8; V. 8; A. 23; C. 19. Jordan gives *A. melas* as = *P. pullus*, De Kay and according to the description by the latter, the anal has 17 rays. Jordan's *A. catus* he considers = to De Kay's *P. atrarius* which is described as having 20 rays. I regard these species as so merged into each other that their validity is doubtful. At best, they seem to me mere varieties, and while my specimens do not conform to the descriptions of *A. catus* in the matter of rays in the anal fin, they do so in most other particulars, and therefore I have classed them in this species. In my opinion the genus needs revision.

THE COMMON EEL.

Anguilla rostrata (Le Sueur) De Kay. (Lat. *anguilla*, an eel; *rostra* a beak.)

SYNONYMS.

Anguilla tenuirostris. De Kay.
Muræna rostrata. Le Sueur.
M. bostoniensis. Le Sueur.

There is but one species of this fish on our continent, although it has been described as several. It is even considered by some, M. Dareste, that our species is identical with *A. vulgaris*, the common eel of Europe. I will not enter into the details of specific differences, but will merely say that the eel has small scales imbedded in the skin which can be seen with a magnifying glass of low power, a fact not generally known. The breeding habits of the eel have been a mooted question for centuries, and the most absurd and contrary theories have been advanced concerning them. It is now known that this fish is not bisexual, or "hermaphrodite," but that there are both males and females; that they lay eggs, and that there is an autumnal migration to salt water, in which all do not join. Many remain behind in fresh water and bed in the mud of the pond or other bottoms, and perhaps these are not fertile individuals. Where and how they spawn we do not know, but millions of young ascend the streams during the month of May. They are then about three inches long and of the size of a large knitting needle. They have evidently grown some since hatching for their diameter is then greater than that of the egg. In this connection I will quote an editorial note from *Forest and Stream*, Vol. XI, p. 399, Dec. 19, 1878, headed "The eel's eggs," which says:

"The long vexed question of the eel's mode of reproduction is now set at rest. Mr. Fred Mather has reduced the evidence to the form of a 'mathematical certainty,' by actually counting the eggs in a specimen. Happening to be in Mr. Blackford's office a short time ago when a six-pound eel with spawn was brought for examination, Mr. Mather proposed a computation of the eggs. He took the ovary home. Under the microscope the eggs appear to be of an octagonal form, but this is due wholly to their pressing upon one another; when separated they assume the globular form. The use of the micrometer failed to give satisfactory results because the eggs varied greatly in size. Mr. Mather therefore placed a number in line, measured and counted them, and found them to average 80 to the inch. Then he took the whole mass of eggs, halved, quartered, and further divided, seventeen times in all, until the section small enough to count represented 1–131,072

of the total number. The count showed 68 eggs, or 8,912,896 in the whole. A second computation in the same way showed 77 eggs in the counted mass, or 10,092,544 altogether. And to make the computation still more certain, a third count was made which showed 71 eggs in the last division, or 9,306,112 in the whole ovaries. From these results Mr. Mather fixes the number of eggs in this particulor eel at fully nine million."

The *Forest and Stream* gave me too much credit in setting the "question at rest." This had been done by others long before, and Prof. Baird had specimens with eggs in the National Museum. I merely estimated the number of eggs in what has long been known to fishermen, "as eel fat" in the fall of the year, but which are the ovaries beyond all doubt. This estimate has been used in Packard's Zoölogy and other text books. Those who wish to follow out the history of the reproductive organs of the eel are referred to the Reports of the United States Fish Commission, 1873–5, pp. 719–734; 1879, pp. 458–483, where the discoveries of Syrski, Virchow, Hermes, and others are given, and these scientists all agree that the fish are oviparous. *Forest and Stream*, Vol. XII, p. 145, Hon. R. B. Roosevelt, in an article inclines to the opinion that they may be viviparous. Ibid. p. 164, Mr. A. R. Fuller thinks he has found eels with ripe eggs at three different times in seven years (in Meacham lake?), each time in the month of May. Ibid. p. 346, Mr. Thomas Clapham, of Roslyn, Long Island, found no young eels above the outlet of his pond but thousands trying to get up from salt water. Mr. Roosevelt has read a paper before the American Fish Culturists' Association, in which he holds that the eels breed in his trout pond, on Long Island, and the young go down to sea. The general opinion of those who have studied this question, and I incline to think they have the best evidence on their side, is that all eels go to salt water to breed and that only barren ones stay in fresh water during the winter. The enormous migration of young eels up stream in the spring, and the fall migration of adults in autumn, support this view. The fact that a male eel has never been taken in fresh water does not count in this argument, for but few have ever been found in salt water. I was present in Berlin when Dr. Hermes essayed to demonstrate before Prof. Virchow and other eminent anatomists, the external characters by which the male eel could be distinguished, but was not convinced that his formula was infallible.

Eels are found in many Adirondack waters, and I have no doubt that they exist in lakes and streams where their presence is not suspected. They will take to the grass, on wet nights, to go around falls which are impassable, and I do not know of

any thing short of a formation like Niagara which can bar them, for there the long stretch of perpendicular wall below the falls prevents their going around. A most complete summary of all that is known of the breeding habits of eels has been made by Prof. G. Brown Goode, Bulletin United States Fish Commission, Vol. I, 1881, pp. 71–124. Concerning the climbing habits of eels, Mr. H. D. McGovern read a paper before the American Fish Culturists' Association, which will be found in their report for 1880, pp. 19–20. I can vouch for the truth of the statement. He says: "On the 22d day of June, 1879, I invited Mr. Fred Mather to take a trip on Long Island with a view to capturing a few trout. We walked along the banks of Spring creek, a small stream in the township of Jamaica, which empties into Jamaica bay. We reached the conduit of the Brooklyn water works where it passes over the creek. The stream contained many eels, the largest being about the size of a No. 4 needle. The buttresses of the conduit-house have two square openings, or arches, through which the waters of the creek pass very rapidly, at no time reaching within twelve inches of the top of the opening. It was our wish to possess some of these small eels; one of the boys proposed to catch some for us and at once procured a handful of damp moss from the upper portion of the opening containing about ten young eels. We suspected that the boys had a vessel hanging in the aperture whence they had taken the eels, wherein they might have been placed before. I procured a fence-rail that crossed the pool and thrust my arm into the aperture expecting to find the vessel, but without success. I raked the top with my fingers, and, drawing forth a handful of moss, discovered the eels. We both knew that when young eels are barred by a rapid current or dam, they could climb a perpendicular wall when wet and covered with vegetation, but were unwilling to believe that they could cling like a fly to the ceiling."

On coming out of the woods I published the fact that eels inhabit Adirondack waters, and the statement was received with surprise by several who have fished there for years, among them Mr. H. H. Thompson, secretary of the Bisby Club, an old frequenter of the region. I would refer to the letter from Gen. R. U. Sherman in the account of the lake trout, page 21, and to the reference to the letter of Mr. A. R. Fuller in this article. Mr. Fuller tells me that he has often taken them in Meacham. Dr. C. Hart Merriam writes me that eels are common in Black river and in many of its tributaries, and that they have been taken in Chase's lake weighing ten pounds, as well as in Woodhull waters.

OTHER AQUATIC LIFE.

There is an abundance of aquatic life in the Adirondacks and every form of it has an influence, directly or indirectly, upon the fishes. In the remarks which follow, I will merely attempt to record such species as were observed on my trips, exclusive of aquatic birds, many of which eat fish, and will not attempt scientific descriptions but note their influence upon the fish as far as I may think I am familiar with their habits.

MUSSELS. (*Unios.*)

These were found in the Fulton chain, especially numerous at the lower end, about the Forge House. I do not know the species and do not think they affect fish life in any way unless their young may be free-swimming, as is the case with many mollusks, and in that case they may furnish food for very small fish at certain seasons. Some of the specimens were quite large (four inches).

LEECHES.

Common ; adhering to rocks. I never saw one on a fish nor never took a leech from the stomach of one. They are frequently found on turtles, but their habits are little known to me.

SALAMANDERS.

I saw what appeared to be two different species, if not genera, of what are popularly termed newts, tritons, efts, evets, and salamanders. They were observed in the shallows of the Moose river district but were not captured. One appeared like the spotted newt, *Diemyctylus viridiscens*, Raf., a common Eastern species in brooks and ponds, with large vermilion dots on the sides; the other seemed to be without these spots and was larger and of a dark brown, like *Desmognathus nigra*, (Green) Baird. Trout in confinement will eat these animals, but I never found one in the stomach of a wild trout. They may eat the eggs of fishes to some extent but are otherwise harmless. The popular notion that their bite is poisonous is erroneous. I do not know that they ever bite persons and I have handled hundreds of them.

INSECT LARVÆ.

To attempt to enumerate this class would be an enormous task. They all furnish fish food, while some, like the dragon-fly, are destructive to young fish. The larvæ of musquitoes, "black flies," gnats, midges, and "punkies," all live through the winter in the water, and are devoured by small fish by the thousands. I will confine my remarks

in this class to one species which I was surprised to find so far above the sea level. This was the larva of the helgramite fly. *Corydalis cornutus*, Say; belonging in the Order *Neuroptera*, or nerve-wings. The larva of this insect is a famous bait for black bass and is variously called dobson, helgramite, devil-catcher, bloomer, crawler, alligator, grampus, hellion, etc. This larva grows to three inches in length, and I imagine that its formidable pair of nippers are more frequently used on other insect larva and water beetles than upon fish. It is usually found under stones in swift brooks, but I took it in lakes for the first time on this trip. They eat decaying vegetation to some extent, and I am not prepared to say whether they eat animal matter at all, or not.

"THE QUEER ANIMAL."

While bathing in Fourth lake from the island where Fred Hess has his camp, I turned over some stones to see what life might be adhering. I found several objects which looked like scales, or the silk-like covering with which some spiders cover their eggs when laid under stones. I picked them off with a knife and found a chitonous scale as large as my thumb nail and an animal below it which appeared not unlike the "horse-foot crab" of salt water (*Limulus*). Counting the legs I found only six, showing that it was not a crustacean but the larva of an insect. They were sent to the Smithsonian Institution with the rest of the collection and labelled by me "the queer animal." The following letter was received from Mr. Rathbun, Curator of the Department of Invertebrates:

U. S. COMMISSION OF FISH AND FISHERIES,
WOOD'S HALL, MASS., *July* 14, 1883.

Dear Mr. MATHER:

I have just received the following note regarding your curious specimen from the Adirondacks. "It is a coleopterus larva, named *Psephenus Lecontei*, belonging to a small family, *Psephenidæ*, between the *Cistelidæ* and *Histelidæ*. It represents a very peculiar type." I think this may be the living trilobite described by De Kay, in his Zoology of New York, which you can easily look up. I will do the same when I return to Washington.

Very truly, RICHARD RATHBUN.

The following is the description of *Fluvicola herricki*, referred to, Mollusks and Crustaceans of New York, plate X, fig. 37. Figs. 38, 39; magnified. Body ovate elliptical, membraneous and flexible, consisting of twelve segments vaulted in the centre, and becoming thin and translucent on the edges; its whole disk margined with subequal closely approximated hairs. The head, or anterior segment with faint

sutures dividing it into three pieces; near its junction with the first segment of the body is a dark colored spot, which, under the lens, presents a tubercular appearance. The two following segments are broader than the eight succeeding ones, and all, except in last, are divided by two longitudinal fissures into three series of lobes, giving to the animal a striking resemblance to trilobites. The edges of the central plates, where they touch each other, are considerably elevated; the lateral plates free and admit of motion over each other. The whole upper surface is irregularly marked with serpentine lines and small round spots; beneath, the mouth appears under the junction of the anterior segment with the following, resembling a short sac or tube with a transverse opening; and on each side two dark processes, apparently the rudiments of jaws; antennæ four; the two anterior longest, curved, not reaching the outer margin of the buckler; the two inferior straight. Immediately posterior to the mouth arise three pair of unguiculated feet, of which the posterior pair is shortest; they were furnished with scattering rigid hairs and with a single black hook at the tip. Posterior to these feet are five pair of branchiopodal processes, resembling bunches of white tendinous filaments. Under a powerful lens, a dorsal vessel may be traced on each side communicating with each tuft of filaments. Each tuft appears divisible into two, and these again are composed of seven or eight single filaments. Color greyish brown. Length, 0·2-0·3. This singular crustaceous animal is found adhering to rocks in and near the waters of West Canada creek. It is detached with considerable difficulty, and when so detached, partially rolls itself up. It was thought a singular coincidence that animals bearing so strong an external resemblance to trilobites should be found at the most remarkable locality in the United States for these extinct animals. It is not supposed that they properly belong to this order, to which they are however allied by external form; but the form of the mouth compels us to arrange it among the Branchiopodal crustacea, or *crustacés suceurs* of more recent writers. I feel much indebted to M. I. Cozzens for another species from Rye, Westchester Co., N. Y."

I cannot say how near this description applies to the specimens found by me as I put them in a vial of alcohol and sent them to Washington without further inspection, not remembering De Kay's figure, and beside this I know nothing of insects. They are, according to the letter from Mr. Rathbun, the larva of some water beetle, and not a crustacean, as De Kay thought.

CRUSTACEANS.

The only crustaceans gathered were the common crayfish, *Astacus* sp., and the little "fresh water shrimp," *Gammarus* sp. Both these

are excellent fish food, especially the latter, which are always more abundant than the crayfish, and form an important item in the menu of the trout.

DISTRIBUTION OF THE FISHES.

In order to arrive at some knowledge of the range of species in the Adirondack waters, I had the following questions published in *Forest and Stream* and then printed on slips and mailed to many who had a more perfect knowledge of localities than I possessed. The answers came promptly, and were in general satisfactory, though in some cases there are contradictions. As before stated, the "miller's thumb" is not generally known, and there is often a misunderstanding as to the identity of the fish, called by fish culturists, the "land-locked salmon." The card was as follows:

In order to obtain a complete knowledge of the distribution of different species of fishes inhabiting Adirondack waters, I would feel under obligations to persons having knowledge of the subject if they would give me the benefit of it for my forthcoming paper, to be published in the next report of Mr. Verplanck Colvin, Superintendent of the Adirondack Survey, to the Legislature of New York. In order to facilitate answering, I have formulated the following questions, which may be referred to by the number alone:

1. What waters in the Adirondacks do not contain brook trout?
2. What lakes do not contain the lake trout, commonly called "salmon trout," or "salmon?"
3. What waters contain eels?
4. Where have you found the fish known by the names of bullhead, catfish or bullpout?
5. Where do you find black bass?
6. What waters contain pike or pickerel?
7. In what lakes do you find a fish called frost fish, whitefish or shad?
8. Do you know of any lakes that do not contain the little fish called sunfish, pumpkin seed, etc.?
9. Where is the "miller's thumb" found?
10. What waters have been stocked with land-locked salmon?
11. Where have the rainbow or California trout been placed?
12. Are there any lakes which do not contain suckers of any species; if so, which ones do not?
13. Have you found more than one species of sunfish in any waters; if so, what are they?
14. Give any other facts that may be of interest?
15. Where are yellow perch found?

FRED MATHER,
Assistant on U. S. Fish Commission.
Fishery Editor *Forest and Stream.*

ANSWERS.

From Mr. C. P. Williams, President of the Albany National Exchange Bank:

I gladly reply to your list of numbered inquiries, and in doing so will confine myself to the waters of Jerseyfield lake on the borders of Hamilton and Herkimer counties, and its neighboring streams and smaller lakes from three or four miles distant, unless otherwise stated.

1. I know of none which certainly do not contain the brook trout.
2. None of the waters about Jerseyfield contain them.
3. Not an eel. Never saw one.
4. I have occasionally (rarely) taken a bullhead in Jerseyfield, and on one occasion one in one of the smaller tributary lakes.
5. None in our waters.
6. No pike or pickerel in our waters.
7. Do not know it in our waters.
8. Never saw or heard of one in our neighborhood.
9. If I know the miller's thumb, never saw one in our waters.
10. None with us.
11. None.
12. We find the common sucker quite abundant in some of our streams; occasionally take one with the hook in our lake.
13. None.
14. We find the brook trout, *Salmo fontinalis*, in our waters having free connection, varying so much in appearance and condition as to produce at times the impression they must be of different varieties; and we find the same peculiar characteristics almost uniformly in the same waters and in the different localities of the same waters. These differences extend to color and form of the fish, brilliancy of spots, etc., and to condition and activity of the fish. I think, however, on more observation, that the race variety of the fish is the same; the variations arising, probably, from differences in food, water, the bottom, etc., etc.
15. I know of no yellow perch in the Adirondacks except at Lake George. My researches, however, have not been very extended.

From E. L. Sheppard, Guide to the Brown Tract.

1. No brook trout in Binny chain of lakes.
2. ———.
3. The Black River canal introduced eels into Woodhull reservoir and its tributaries. Mr. C. Cowdry and myself took the first in Woodhull in 1860.
4. In most lakes of Brown's tract.
5. White lake, Raquette lake.

6. Brantingham lake, Raquette lake and Long lake.

7. No lakes except where salmon trout are found, and not all of these; never in water less than forty feet. Common in the Fulton chain.

9. Big Moose and Fulton chain.

14. The original fish in these waters occur in frequency in the following order: Black-nosed dace, common or horned dace, sunfish, suckers, brook trout, shiners, bullheads, miller's thumb, salmon trout, frost fish. White lake is the only one of the Black river waters above Moose River junction containing frost fish. John Van Valkenburg and myself put salmon (?) in Lime Kiln lake in the winter of 1876–7 and they are doing well. Little Moose has California salmon; * Lake Ontario white fish were put in it, but none have been caught. The north branch of the Moose river has only the above ten species except the rainbow trout, which were planted last winter. Many small ponds do not appear to contain any fish, perhaps because there is no visible outlet, or they are too shallow. Binny chain and Woodhull reservoir contain no shiners.

From H. D. Grant, G. Riggs and E. N. Arnold, Boonville, N. Y.:

1. Remson lake, Bug lake, Chub pond.
2. Mick's lake, John's lake.
3. None.
4. In all the lakes.
5. In Raquette, and below the forge, Moose river.
6. None in Brown's tract.
7. Fulton chain, Moose lake, North Branch chain, Little Moose.
8. Bug lake.
9. Give it up.
10. Little Moose, Woodhull and Bisby lakes.
11. Black river waters.
12. None that we know of.
13. No.

From Silas Call, Wells, N. Y.:

1. None.
2. All have them.
3. Rivers.
4. All waters.

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* I think this a slip of the pen. I do not think that *Oncorhynchus chouicha* has ever been planted in Adirondack waters. Sheppard may mean the rainbow trout, but I have not communicated with him since receiving his letter. He undoubtedly means to say California trout, a name applied to the rainbow trout in the east. See foot note, page 53.

5. None.
6. Indian lake, Long lake.
7. In all lakes, but are scarce.
8. No.
9. Don't know it.
11. South branch of Sacandaga.

From Simeon C. Dunham, Ashton, Hamilton county·

1. Coal lake, Scuts lake, Tea lake, Willis lake, Murphy lake and Warner lake. All these lakes contain neither lake trout nor "pumpkin seeds."

2. See above ; G lake, Sand lake, Sherif lake, Fall lake, Fly lake, Oxbow lake, Mud lake, Elm lake and Spy lake.

3. Piseco, Round and Pleasant lakes.

4. Piseco, Round, Pleasant, G, Sand, Mud, Oxbow, Fall, Fly, Spy, Spruce, Balsam, Trout, Halfmoon and South lakes and West Canada lake brook.

5. No black bass in any of the above waters.

6. Willis, Murphy and Gates lakes and the Sacandaga river.

7. Piseco, Pleasant and Round lakes.

8. The waters named in No. 1.

9. There is no miller's thumb in the above waters.

10. Piseco, Pleasant and Round lakes.

11. Stony creek and Wilcock streams.

12. Coal, Scuts, Tea and Warren lakes.

13. Have not seen but one species of sunfish.

14. The following waters contain brook trout : Lakes Piseco, Round, Pleasant, Sand, Mud, Sherif, G, Spruce, Balsam, West Canada, Halfmoon, South, Spy, Fall, Fly, Elm, Oxbow, Pine, Little Round, Rock, Whitcher, Mason, Dug Mountain, Lewey, Indian, Raquette, Silver, Canary, Bennett, Jones, Wilcox, New, Whitney, Sampson, Otter, Moose and Pilsbury. Also Long pond. The waters containing lake trout are : Piseco, Round, Pleasant, Indian, Raquette, Spruce, Balsam, Lewey and West Canada lakes.

From S. J. Palmer, State Game Protector, Indian lake, Hamilton county :

1. None.
2. None.
3. None.
4. All waters.
5. Raquette lake and possibly Blue Mountain lake, although Fulton is on information obtained this year from Henry Bradly, stage agent, who says the bass have gotten into Blue Mountain, Eagle and Utowana lakes.

6. Indian lake and river, Long lake, Raquette river, Big Tupper's lake and Center pond (this is a pond on township 15, the pond is on the line between Hamilton and Essex counties. See four measured ponds where Essex and Warren touch Hamilton).

7. Blue Mountain and Raquette and the lakes between.

8. None.

12. None.

From Capt. L. A. Beardslee, U. S. N., Little Falls, N. Y.:

FRIEND MATHER — In reply to queries I chip in my small stock:

1. Spectacle and Dexter lakes are said to be now free from brook trout. Twenty-five years ago I caught fair quantities in both, but the introduction of pickerel, which had been made some years previously, was given me then, by my guide, a "shingle weaver," named Charles Bennet, who shantied for years in the vicinity, as the cause of the great reduction in the trout product which even then had taken place.

3. Piseco, Lake Pleasant, Mud and Round lakes.

4. Piseco and Lake Pleasant.

5. Raquette forked and connections; Utowana and Blue Mountain chain.

6. Spectacle and Dexter lakes.

7. Piseco.

8. No.

9 to 13. Have no certain knowledge.

14. In Piseco, Lake Pleasant and Round lakes, in early spring schools of "golden shiners" are found in certain portions of Piseco; they come from shallow bays where there is much dead timber, etc., caused by back set of water by the dam, and migrate up the lake generally along the south shore to the spring brooks at the head. The lake trout follow them, and while the shiners are moving a laker is seldom taken in any other part of the lake or by deep trolling, or by any thing but a yellow spoon, a shiner on a gang.

From Frank Usher, Potsdam, St. Lawrence county.

1. Do not know of any.

2. Amber lake, Jordan lake and Indian lake.

3. The Lower Raquette.

4. In all small ponds and Raquette river.

5. Is not found except in the Upper Raquette, where they have been planted.

6. Raquette river, where they were placed about twelve years.

7. Massawepio lake, Big Tupper lake, Big Wolf lake and Trout lake.

8. Do not know of any.

9. Have been seen in Raquette river.
10. Jordan lake.
11. Do not know.
12. Do not know.
13. Never have seen but one kind of sunfish.
14. Have understood that the pickerel were gradually decreasing in Raquette river.

From Watts T. Loomis, Little Falls, N. Y.:

1. Dexter and the three Spectacle lakes, Hamilton county, contain no fish except pickerel and minnows. They were formerly full of speckeled trout.

2. None of the lakes on the head waters of either the West or East Canada creeks contain salmon. East Canada lake: Ferris Jockeybush, Black-cat, House ponds, Klock Mill, Christian and Morehouse lakes. West Canada lakes: Mud pond, Jock's, Jerseyfield, Trout and Gee lakes and others that I do not know the names of. The two Trout lakes and Goodluck lake on the Sacandaga.

3. Piseco, Woodhull, and Mud lake, just below Woodhull, I have never paid much attention.

4. Ferris and Jockeybush, and probably all on the East Canada creek.

5. I do not know.

6. Answered in No. 1.

7. Piseco, Round lake, the Fulton chain and White lake, Oneida county.

8. Am unacquainted with it.

10, 11, 12, 13 and 14. I can give you no information.

From S. R. Fuller, Holland Patent:

1. I know of none.

2. Herkimer county: Jock's lake, Little Salmon, North lake, Horn lake, Little Woodhull, Twin lakes, Stone-dam lake, Chub lake.

3. Chub lake.

4. Little Woodhull.

5. Black river, near State dam.

7. White's lake.

10. Big Woodhull, Butler's lake.

12. Horn lake, Jones lake.

From D. F. Palmerton, Piseco, Hamilton county:

1. Spy lake, T lake, Oxbow and the Midkifs.

2. The above lakes and Pine, G, L, Sherif, Morehouse, Sand, Mud, Tall, Fly and other lakes.

3. None.

4. All the above.

5 and 6. None.

7. Nearly all waters which contain salmon trout.

From E. F. Beardslee, Gouverneur. I saw the card in *Forest and Stream* and wish to contribute from my limited knowledge of the waters of St. Lawrence county between Cranberry lake and Lewis county.

1. Long pond, Tamarack pond and Partolo pond (not the pond of that name in Herkimer county). All others contain brook trout.

2. No water here except Big lake and Sucker lake have lake trout, and these were stocked with them by the New York Fish Commission four years ago.

3. None.

4. In most ponds, lakes and rivers.

5. Sucker lake and Partolo pond.

6 and 7. None.

8. All ponds and lakes.

9 and 10. Do not know of any.

11. No rainbow trout on this side of the Adirondacks. We put in some in the spring of 1882 in Sylvan lake, town of Fowler, St. Lawrence county, and also in the Oswegatchie river, nine miles above this place.

12. Do not know of any waters which do not contain suckers.

13. Think there are several species but cannot describe them.

From S. D. Andrews, proprietor Lake Pleasant House, Sageville, Hamilton county :

1. There are no lakes in my vicinity but have either lake or brook trout, and many have both.

2. Some of the smaller sized lakes.

3. Most of the large lakes ; not plenty but large, from three to twelve pounds.

4. In most all the lakes and rivers; plenty.

5 and 6. None in this vicinity.

7. We find them in all waters where the lake trout are found.

8. No ; they are plenty here.

9. I do not know the fish.

10. Lake Pleasant and Round lake.

11. Near the inlets of Lake Pleasant and Round lake.

12 and 13. No.

14. My aim is to keep the waters stocked with the game fish of the woods, the brook trout.

From Col. J. T. Watson, Clinton :

1. None except some stagnant ponds, like Mosquito and Middle ponds, lying between the Tupper and Saranac lakes.

2. Many small lakes in the Moose river tract and in the Arthurboro Patent, Big Rock, Little Rock, Snag, Wilmurt, Morehouse, Bug lakes and Eagle lake, near the Fulton chain.

3. Do not know.

4. Snag lake.

5. Never found any black bass.

6. Long lake, Raquette river and Big Tupper lake.

7. In the Fulton chain of lakes.

8. There are comparatively few that do contain sunfish.

9. Don't know.

10 and 11. The Fulton chain, Woodhull and Bisby.

12. I never found any suckers in Lime Kiln.

13. No.

14. In my journeyings through the Adirondacks for more than twenty years, have met with but few fish in the cold ponds except trout. One season found myriads of suckers in Big Raquette lake.

From Col. J. T. Watson, Clinton, N. Y. :

1. Am not aware of any except a few stagnant ponds like Mosquito pond and Model pond, lying between the Tupper and Saranac lakes.

2. A large number of small lakes in the Moose river tract and Arthurboro Patent. Big Rock, Little Rock, Snag, Wilmurt and Morehouse ; also Bug and Eagle lakes, near the Fulton chain.

3. Do not know.

4. In Snag lake, Arthurboro patent.

5. Never found any.

From Gen. R. U. Sherman, of the New York Fish Commission, New Hartford, N. Y. :

1. T lake, tributary to east branch West Canada creek ; Metcalf lake, tributary to the north branch of the same. The chain of Bisby lakes and the two small ponds above did not contain brook trout till 1877, when they were stocked from the New York State Hatchery. They are now abundant, having spawned each year since 1878. In the case of all these waters high falls intervene between waters below which contain brook trout. This fact gives support to the theory that brook trout came up to the interior from brackish waters.

2. None of the lakes of the West Canada creek, except Spruce lake, which is the extreme source of the north branch, and is separated from the large lake Piseco, tributary to the Hudson river, by a narrow dividing ridge. These lakes are, T lake, G lake, Pine lake, Sucker Brook lake and Wilmurt lake on the east branch, and Big Rock,* Lit-

* 10,000 salmon trout from New York State Hatchery were planted in Pine lake in 1880, and 10,000 in Big Rock in 1881. Results not yet ascertained.

tle Rock, Snag, Gid's, Jock's,* Jones, Deer, Otter, Goose, Little Salmon and some small lakes whose names are not known, on the north branch. The first lake on the north branch of Moose river. All these lakes except Jock's are small. It may be set down as a rule that salmon trout are not found in shallow lakes nor in any that are not supplied with cold spring water, nor in running streams, however pure and cold. They are sometimes found in quite small lakes, but in these cases there is always great depth and coldness. I have not in my experience found salmon trout in any water where the maximum depth was less than forty feet.

3. Mud lake, Sand lake and the Bisby lakes, tributaries of Black river.

4. In Snag lake, tributary to north branch of West Canada creek; in several small ponds tributary to that stream, and in spring holes north branch of Moose river.

5. Only where artificially planted, viz.: in Raquette lake, White lake, Fourth Bisby, the last two tributaries of Black river, and in Black river at Forestport.

6. Long lake.

7. Frost fish in the lakes of the Fulton chain, Little Moose lake on the south branch, and White lake, tributary to Black river.

8. I have found sunfish only in Piseco and G lakes.

9. I have never seen the miller's thumb in the wilderness waters.

10. Woodhull lake (tributary to Black river). From this lake the fish have passed into Mud and Sand lakes, from which they came up to the foot of Woodhull in the fall of 1882 to spawn.

11. The rainbow or California trout have been placed in running waters connecting Fulton chain, in Woodhull lake, in south branch of Moose river below Lime Kiln falls and in running waters between First and Second Bisby.

12. Wilmurt contains no suckers (this lake contains no fish whatever except brook trout; it has, however, "lizards" [newts] and leeches), nor do the four lakes of the Bisby chain. Many of the small lakes mentioned in the answers to question No. 2 are also free from suckers.

13. No.

* Salmon trout and California salmon fry were put into this lake seven or eight years ago, but none of these kinds of fish have ever been caught there. The lake is four miles long, one hundred feet deep in some places, nowhere shallow, and made up of cold spring water of the purest quality. The bottom is rock and sand. The most reasonable theory why these fry have not been heard from is that they were in an exhausted state from long transportation and perished through weakness or were devoured by the native fish.

RECAPITULATION.

From these answers and information otherwise obtained, it appears that the distribution of species in the Adirondacks may be partly shown by the following summary of answers to the questions given:

1. What waters in the Adirondacks do not contain brook trout? Metcalf and T lakes, tributaries of West Canada creek; Spectacle, Dexter, Spy, Oxbow, Midkifs, Coal, Scuts, Willis, Murphy, Warner, Remson and Bug lakes. Long, Tamarac and Chub ponds. All other waters are supposed to contain them. None were found in Bisby and the small lakes above it until they were stocked by the New York Fish Commission in 1879, and they are now abundant.

2. What lakes do not contain the lake trout, commonly called "salmon trout," or "salmon"? None of the lakes of West Canada creek except Spruce lake (these are T, G, Pine, Little Rock, Snag, Gid's, Jock's, Jones, Deer, Otter, Goose, Little Salmon and Sucker Brook lakes). Amber, Jordan, Indian, Ferris, Jo Jockeybush, Black Cat, Klock, Mill, Christian, Morehouse, Mud, Jerseyfield, Trout, Good Luck, Spy, Oxbow, Midkifs, Sherif, Sand, Fall, Fly, Long, Spruce, Canada, Coal, Scuts, Willis, Murphy, Elm, Mick's, John's, Jock's, North, Horn, Little Woodhull, Irvin, Stone Dam, Chub, Big Rock, Wilmurts (?), Bug, the Eagle chain, Big and Sucker lakes, the last two in St. Lawrence county, have been stocked with them. One correspondent gives Lewey lake as containing no lake trout. It was from this lake that De Kay obtained the abnormal specimen which he founded his new species, *Salmo confinis* upon, but no similar fish has since been found by a naturalist. See reply of S. C. Dunham.

3. What waters contain eels? Mud, Sand, Bisby, Piseco, Pleasant, Round, Woodhull, Chub, Meacham, Raquette and the Fulton chain of lakes.

4. Where have you found the fish known by the names of cat fish, bullhead or bullpout? Snag lake and the small ponds tributary to West Canada creek, Piseco, Pleasant, Raquette, Ferris, Jockeybush, Round, G, Sand, Mud, Meacham, Oxbow, Fall, Fly, Spruce, Balsam, Trout, Halfmoon, South, Snag, Little Woodhull and the Fulton chain of lakes. Clear pond, near Meacham, and in most waters of St. Lawrence county.

5. Where do you find black bass? Raquette, Forked, White, Fourth Bisby, Sucker, the Blue Mountain chain and the Fulton chain of lakes, Moose river, Black river and Partolo pond (St. Lawrence county). Only in waters where they were planted and those to which they have strayed.

6. What waters contain pike or pickerel? Long, Spectacle, Dexter, Willis, Murphy, Gates and Tupper lakes; the Raquette and Sacan-

daga rivers; Indian lake and river; Center pond in township 15, between Hamilton and Essex counties. (See four unnamed ponds where Essex and Warren touch Hamilton county. S. J. Palmer.)

7. In what lakes do you find a fish called frost fish, white fish or shad? The Fulton chain, Little Moose, Big Moose, White, Piseco, Massawepis, Big Tupper, Big Wolf, Trout, Round, Pleasant, Moose, Raquette and the Blue Mountain lakes, North Branch pond and Clear pond, near Meacham. Mr. H. H. Thompson, secretary of the Bisby Club, tells me that the Fulton chain did not originally contain them, but that they were planted there.

8. What lakes do not contain sunfish? Piseco, G, Coal, Scuts, I, Willis, Murphy, Warner and Bug lakes.

9. Where is the miller's thumb found? Big Moose lake, Raquette river and streams near Malone.

10. What waters have been stocked with land-locked salmon? Woodhull, Mud, Sand, Little Moose, Bisby, the Fulton chain, Jordan (?), Butler (?) and Pleasant (?) lakes. (I have queried these because I think my correspondents have confounded this fish with the lake trout.)

11. Where have the rainbow (California) trout been placed? The Fulton chain, Woodhull, Bisby, Pleasant, Round, Horn and Jones lakes, south branch of Moose river, Oswegatchie river, Black river waters, and Silvia lake, St. Lawrence county.

12. What lakes do not contain suckers? Wilmurt, Bisby, Coal, Scuts, I, Warren and Lime Kiln. (It is more than likely that they will be found in all Adirondack waters upon careful examination.)

13. Have you found more than one species of sunfish? The answers to this were few and I incline to think there is but one.

In conclusion, I will say that there are many interesting and valuable facts yet to be learned concerning the Adirondack fishes; such as the comparative abundance of different species in each of the water systems in order to arrive at a knowledge of their relations to each other, as food, enemies and rivals in the struggle for existence; the causes which give one species an ascendency in certain waters and subordinate it in another, and many other things which would add to our knowledge. I can only wish that my stay had been longer, for it merely whetted my appetite for the study of the fish fauna of these mountain waters. I am aware that this report is crude and possibly it may contain errors, but had it not been for the

general interest taken in the work by the guides, anglers who were met in the woods, and others who kindly responded to my inquiries in *Forest and Stream*, and other friends who are more familiar with the Adirondacks than I am, the errors would have been much more numerous.

Respectfully submitted,

F. MATHER.

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